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External Balances, Trade Flows and Financial Conditions

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This paper studies how changing expectations concerning future trade and financial conditions are reflected in international external positions. In the absence of Ponzi schemes and arbitrage opportunities, the net foreign asset position of any country must, as a matter of theory, equal the expected present discounted value of future trade deficits, discounted at the cumulated world stochastic discount factor (SDF) that prices all freely traded financial assets. I study the forecasting implications of this theoretical link in 12 countries (Australia, Canada, China, France, Germany, India, Italy, Japan, South Korea, Thailand, The United States and The United Kingdom) between 1970 and 2011. I find that variations in the external positions of most countries reflect changing expectations about trade conditions far into the future. I also find the changing forecasts for the future path of the world SDF is reflected in the dynamics of the U.S. external position.

Keywords: Global Imbalances, Foreign Asset Positions, Current Accounts, Trade Flows, International Asset Pricing

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1 Introduction

This paper studies how changing expectations concerning future trade and financial conditions are reflected in international external positions. Economic theory links a country's net foreign asset (NFA) position to agents' expectations in a precise manner. In the absence of Ponzi schemes and arbitrage opportunities, the NFA position of any country must equal the expected present discounted value of future trade deficits, discounted at the cumulated world stochastic discount factor (SDF) that prices all freely traded financial assets. In practice this means that changes in observed external positions of countries across the world should reflect changing expectations about future trade flows and future financial conditions represented by the world SDF, or some combination of the two. The aim of this paper is to assess whether this is in fact the case. More specifically, the paper examines the extent to which changing expectations about future trade and financial conditions are reflected in the evolving external positions of 12 countries between 1970 and 2011.

To undertake this analysis, I present an new analytic framework that links each country's current NFA position to its current trade flows, expectations of future trade flows, and expectations concerning future returns on foreign assets and liabilities in an environment without arbitrage opportunities or Ponzi schemes. This framework incorporates several key features. First it accommodates the secular increase in international trade flows and national gross asset/liability positions that have taken place over the past 40 years. The secular growth in both trade flows and positions greatly exceeds the growth in GDP on a global and country-by-country basis. Between 1970 and 2011, the annual growth in trade and positions exceeds the growth in GDP by an average of 2.6 and 4.8 percent, respectively, across the countries studied.[1]

The second key feature concerns the identification of expected future returns. As a matter of logic, expected future returns on a country's asset and liability portfolios *must* affect the value of its current NFA position, so pinning down these expectations is unavoidable when studying the drivers of external positions. This is easily done in textbook models where the only internationally traded asset is a risk free bond, but in the real world countries' asset and liability portfolios comprise equity, FDI, bonds and other securities, with risky and volatile returns. Pinning down the expected future returns on these portfolios requires forecasts for the future returns on different securities and the composition of the portfolios. To avoid these complications, I use no-arbitrage conditions to identify the impact of expected future returns on NFA positions via forecasts of a single variable, the world SDF. SDFs play a central role in modern finance theory (linking security prices and cash flows) and appear in theoretical examinations of the determinants of NFA positions (see, e.g., Obstfeld, 2012). A key step in my analysis is to show how the world SDF can be constructed from data on returns and then used to pin down how expectations concerning future financial conditions are reflected in external positions.

[1] This feature of the data has proved to be a challenge for researchers studying the determinants of external positions, see e.g., Gourinchas and Rey (2007a) and Corsetti and Konstantinou (2012) discussed below.

In the empirical analysis I study the external positions of 12 countries (Australia, Canada, China, France, Germany, India, Italy, Japan, South Korea, Thailand, The United States and The United Kingdom). I first show how the world SDF can be estimated from data on returns and discuss how the estimates can be tested for specification errors. Next I turn to the identification of expectations. In theory, external positions reflect expectations concerning the entire future paths of trade flows and the world SDF, so we need to forecast over a wide range of horizons. For this purpose I use VARs - a common approach in the literature following Campbell and Shiller (1987). I then compare the present values of future trade flows and the world SDF based on the VAR forecasts with external positions. If the actual expectations embedded in the external positions are well represented by the VAR forecasts, the present values computed from those forecasts should be strongly correlated with the external positions. This implication is borne out by my empirical findings using the VAR forecasts for trade flows. Forecasts of trade flows far into the future are strongly correlated with the external positions of 10 countries I study. Evidence on the role of expected future financial conditions is less clear cut. While VAR forecasts for the world SDF suggest that there have been persistent and sizable variations in the prospective future financial conditions that are relevant for the determination of external positions, the forecasts are only weakly correlated with the positions of many countries. One notable exception to this pattern is the United States, whose external position is strongly correlated with the forecasts.

These findings add to a growing empirical and theoretical literature on international external adjustment. The analytic framework I present is most closely related to the work of Gourinchas and Rey (2007a). They derive an expression for a country's NFA position from a "de-trended" version of the consolidated budget constraint (that governs the evolution of a country's NFA position from trade flows and returns), that filters out the secular growth in trade flows and positions mentioned above. Thus their analysis focuses on the "cyclical" variations in NFA positions, rather than the "total" variations. Similarly, Corsetti and Konstantinou (2012) use the consolidated budget constraint to derive an approximation to the current account that includes deterministic trends in the log ratios of consumption, gross assets and gross liabilities to output to accommodate the long-term growth in trade flows and positions (relative to GDP).[2] On the theoretical side, Pavlova and Rigobon (2008), Tille and van Wincoop (2010) and Devereux and Sutherland (2011) all study external adjustment in open economy models with incomplete markets. In these models changing NFA positions primarily reflect revisions in expected future trade flows and the world risk-free rate because the equilibrium risk premia on foreign assets and liabilities are (approximately) constant. In contrast, the framework I use allows for variations in the risk premia on assets and liabilities to also affect NFA positions.

My analysis also extends a related literature on international returns. Early papers in this

[2]A related literature on external adjustment focuses attention on current account balances. For example, Lane and Milesi-Ferretti (2012) examine how changes in current account balances between 2008 and 2010 relate to pre-crisis current account gaps estimated from a panel regression model. Similar empirical models of current account determination can be found in Chinn and Prasad (2003), Gruber and Kamin (2007), Lee et al. (2008), Gagnon (2011) and others. Current accounts also remain a focus in current multilateral surveillance frameworks used by the International Monetary Fund and the European Commission (see, e.g., IMF, 2012 and EU, 2010).

literature (Obstfeld and Rogoff, 2005; Lane and Milesi-Ferretti, 2005; Meissner and Taylor, 2006 and Gourinchas and Rey, 2007b) estimated that the return on U.S. foreign assets was on average approximately three percent per year higher than the return on foreign liabilities. Subsequent papers by Curcuru, Dvorak, and Warnock (2007) and Lane and Milesi-Ferretti (2009) argued that these estimates were biased upward because of inaccuracies in data. In their recent survey, Gourinchas and Rey (2013) show that alternative treatments of the data can produce average return differentials between U.S. foreign assets and liabilities that differ by as much as 1.1 and 1.8 percent, depending upon the sample period. My analysis shifts the focus away from average U.S. returns in two respects. First, I use the returns on the assets and liabilities of major economies to estimate the world SDF. Second I model how *conditional* expectations concerning the world SDF are related to external positions. Gourinchas and Rey (2007a) also consider the short-horizon (one quarter) forecasting power of the (cyclical) U.S. external position for returns on its NFA portfolio, and the return differential between equity assets and liabilities. Here I study forecasting power of external positions over longer horizons.

The remainder of the paper is structured as follows: Section 2 describes the data. I present the analytic framework in Section 3. Section 4 describes how I estimate the world SDF and compute long-horizon forecasts. I present the empirical results in Section 5. Section 6 concludes.

2 Data

I examine the external positions of 12 countries: the G7 (Canada, France, Germany, Italy, Japan, the United States and the United Kingdom) together with Australia, China, India, South Korea and Thailand. Data on each country's foreign asset and liability portfolios and the returns on the portfolios come from the databased constructed by Lane and Milesi-Ferretti (2001), updated in Lane and Milesi-Ferretti (2009), available via the IMF's International Financial Statistics database. These data provide information on the market value of the foreign asset and liability portfolios at the end of each year together with the returns on the portfolios from the end of one year to the next. A detailed discussion of how these data series are constructed can be found in Lane and Milesi-Ferretti (2009). I also use data on exports, imports and GDP for each country and data on the one year U.S. T-bill rate, 10 year U.S. T-bond rate and U.S. inflation. All asset and liability positions, trade flows and GDP levels are transformed into constant 2005 U.S. dollars using the prevailing exchange rates and U.S. price deflator. All portfolio returns are similarly transformed into real U.S. returns. The Lane and Milesi-Ferretti position data is constructed on an annual basis, so my analysis below is conducted at an annual frequency.[3] Although the span of individual data series differs from country

[3]Ideally, we would like to track international positions and returns at a higher (e.g. quarterly) frequency, but constructing the market value of foreign assets and liabilities for a large set of countries is a herculean task. For the United States, Gourinchas and Rey (2005) compute quarterly market values for four categories of foreign asset and liabilities: equity, foreign direct investment, debt and other, by combining data on international positions with information on the capital gains and losses. In Evans (2012) I revise and update their data to 2012:IV. Corsetti and Konstantinou (2012) also work with quarterly U.S. position data which they impute from the annual Milesi-

to country, most of my analysis uses data spanning 1970-2011.

The Web Appendix describes the characteristics of the data in detail. Here I simply note several prominent features. First, for many countries, variations in the ratios of net exports and NFA to GDP are highly persistent. Second, the cross-country dispersion in the ratios has widened in the last decade. Third, gross financial positions (i.e., the sum of foreign assets and liabilities) and trade (i.e., the sum of export and imports) have grown much faster than GDP. Averaging across all the countries, trade grew approximately 2.6 percent faster than GDP, while foreign asset and liability positions grew 4.8 percent faster. There have also been swings in global trade growth and position growth that are much larger than global business cycles. In light of these facts, the next section presents an analytic framework that links a country's current external position to prospective future trade and financial conditions while accommodating the growth in trade and positions.

3 Analytic Framework

3.1 NFA Positions

The framework I develop contains three elements: (i) the consolidated budget constraint that links a country's foreign asset and liability positions to exports, imports and returns; (ii) a no-arbitrage condition that restricts the behavior of returns; and (iii) a condition that rules out international Ponzi schemes.

I begin with country's $n's$ consolidated budget constraint:

$$FA_{n,t} - FL_{n,t} = X_{n,t} - M_{n,t} + R^{\text{FA}}_{n,t} FA_{n,t-1} - R^{\text{FL}}_{n,t} FL_{n,t-1}. \tag{1}$$

Here $FA_{n,t}$ and $FL_{n,t}$ denote the value of foreign assets and liabilities of country n at the end of year t, while $X_{n,t}$ and $M_{n,t}$ represent the flow of exports and imports during year t, all measured in real terms (constant U.S. dollars). The gross real return on the foreign asset and liability portfolios of country n between the end of years $t-1$ and t are denoted by $R^{\text{FA}}_{n,t}$ and $R^{\text{FL}}_{n,t}$, respectively. Equation (1) is no more than an accounting identity. It should hold true for any country provided the underlying data on positions, trade flows and returns are accurate. Notice, also, that $FA_{n,t}$ and $FL_{n,t}$ represent the values of portfolios of assets and liabilities comprising equity, bond and FDI holdings, and that $R^{\text{FA}}_{n,t}$ and $R^{\text{FL}}_{n,t}$, are the corresponding portfolio returns. These returns will generally differ across countries in the same year because of cross-country differences in the composition of asset and liability portfolios.

Next, I introduce the no-arbitrage condition. In a world where financial assets with the same payoffs have the same prices and there are no restrictions on the construction of portfolios (such as

Ferretti data using quarterly capital flows. For a discussion of the different methods used to construct return data, see Gourinchas and Rey (2013).

short sales constraints), there exists a positive random, $\mathcal{K}_{t+1}$, such that

$$1 = \mathbb{E}_t[\mathcal{K}_{t+1} R^i_{t+1}], \tag{2}$$

where R^i_{t+1} is the (gross real) return on any freely traded asset i. Here $\mathbb{E}_t[.]$ denotes expectations conditioned on common period-t information. The variable $\mathcal{K}_{t+1}$ is known as the stochastic discount factor (SDF). This condition is very general. It does not rely on the preferences of investors, the rationality of their expectations, or the completeness of financial markets.[4] I assume that it applies to the returns on every security in a country's asset and liability portfolios, and so it also applies to the returns on the portfolios themselves; i.e.

$$1 = \mathbb{E}_t[\mathcal{K}_{t+1} R^{\text{FA}}_{n,t+1}] \qquad \text{and} \qquad 1 = \mathbb{E}_t[\mathcal{K}_{t+1} R^{\text{FL}}_{n,t+1}]. \tag{3}$$

Equations (1) and (3) enable me to derive a simple expression for a country's NFA position. First I multiply both sides of the budget constraint in (1) by the SDF and then take conditional expectations. Applying the restrictions in (3) to the resulting expression and simplifying gives

$$\mathbb{E}_t\left[\mathcal{K}_{t+1} NFA_{n,t+1}\right] = \mathbb{E}_t\left[\mathcal{K}_{t+1}(X_{n,t+1} - M_{n,t+1})\right] + NFA_{n,t}. \tag{4}$$

Rearranging this expression and solving forward using the Law of Iterated Expectations we obtain

$$NFA_{n,t} = \mathbb{E}_t \sum_{i=1}^{\infty} \mathcal{D}_{t+i}\left(M_{n,t+i} - X_{n,t+i}\right) + \mathbb{E}_t \lim_{i\to\infty} \mathcal{D}_{t+i} NFA_{n,t+i}, \tag{5}$$

where $\mathcal{D}_{t+i} = \prod_{j=1}^{i} \mathcal{K}_{t+j}$.

The last term on the right-hand-side on (5) identifies the expected present value of the country's NFA position as the horizon rises without limit using a discount factor determined by the world's SDF. To rule out Ponzi-schemes, I assume that

$$\mathbb{E}_t \lim_{i\to\infty} \mathcal{D}_{t+i} NFA_{n,t+i} = 0, \tag{6}$$

for all countries n. For intuition, suppose a debtor country (i.e. a country with $NFA_{n,t} < 0$) decides to simply roll over existing asset and liability positions while running zero future trade balances. Under these circumstances, the country's asset and liability portfolios evolve as $FA_{n,t+i} = R^{\text{FA}}_{n,t+i} FA_{n,t+i-1}$ and $FL_{n,t+i} = R^{\text{FL}}_{n,t+i} FL_{n,t+i-1}$ for all $i > 0$. Since $\mathbb{E}_t[\mathcal{K}_{t+1}\mathcal{X}_{t+1}]$ identifies the period$-t$ value of any period $t+1$ payoff $\mathcal{X}_{t+1}$, (4) implies that the value of claim to the country's net assets next period is just $\mathbb{E}_t\left[\mathcal{K}_{t+1} NFA_{n,t+1}\right] = \mathbb{E}_t\left[\mathcal{K}_{t+1}(X_{n,t+1} - M_{n,t+1})\right] + NFA_{n,t} = NFA_{n,t}$. This same reasoning applies in all future periods, i.e., $\mathbb{E}_{t+i}\left[\mathcal{K}_{t+i+1} NFA_{n,t+i+1}\right] = NFA_{n,t+i}$ for all $i > 0$, so the value of a claim to the foreign asset position τ periods ahead is $\mathbb{E}_t\left[\mathcal{D}_{t+\tau} NFA_{n,t+\tau}\right] =$

[4] For a textbook discussion of SDFs, see Cochrane (2001); or in an international setting, Evans (2011).

$\mathbb{E}_t\left[\mathcal{D}_{t+\tau-1}\mathbb{E}_{\tau-1}\left[\mathcal{K}_{t+\tau}NFA_{n,t+\tau}\right]\right] = .. = NFA_{n,t}$. Taking the limit as $\tau \to \infty$ gives $NFA_{n,t} = \mathbb{E}_t \lim_{i\to\infty}\left[\mathcal{D}_{t+i}NFA_{n,t+i}\right] < 0$. Thus, the country's current NFA position must be equal to the value of a claim on rolling the asset and liability positions forward indefinitely into the future. Clearly then, no country n can initiate a Ponzi scheme in period t when $\mathbb{E}_t \lim_{i\to\infty}\mathcal{D}_{t+i}NFA_{n,t+i} \geq 0$. Moreover, since $\sum_n NFA_{n,t} = 0$ by market clearing, if $\mathbb{E}_t \lim_{i\to\infty}\mathcal{D}_{t+i}NFA_{\tilde{n},t+i} > 0$ for any one country, $\tilde{n}$, then at least one other must be involved in a Ponzi scheme. Thus, the restriction in (6) prevents any country from adopting a Ponzi scheme in period t.

We can now identify the determinants of a country's NFA position by combining (5) and the no-Ponzi restriction (6):

$$NFA_{n,t} = \mathbb{E}_t \sum_{i=1}^{\infty} \mathcal{D}_{t+i}\left(M_{n,t+i} - X_{n,t+i}\right). \tag{7}$$

This equation states that in the absence of Ponzi schemes and arbitrage opportunities, the NFA position of any country n must equal the expected present discounted value of future trade deficits, discounted at the cumulated world SDF. As such, it describes the link between a country's current external position and the prospects for future trade flows (i.e. exports and imports) and future financial conditions, represented by the future SDF's in $\mathcal{D}_{t+i}$.

Several aspects of equation (7) deserve note. First, the equation is exact; i.e., it contains no approximations. It must hold under the stated conditions for accurate NFA and trade data given market expectations and the world SDF. Second, (7) holds whatever the composition of the country's asset and liability portfolios (i.e. whatever the fractions held in equity, bonds, etc.), and however those fractions are determined (by optimal portfolio choice or some other method). Third, the equation applies simultaneously across all countries. If news about prospective future financial conditions anywhere change expectations concerning future world SDFs, it affects the NFA position of all countries that anticipate running future trade surpluses or deficits. Equation (7) also takes explicit account of risk. It states that a country's NFA position is equal to the value of a claim to the future stream of trade deficits in a world where those deficits are uncertain.

Finally, it is worth emphasizing that the expected future trade flows and SDF on the right-hand-side of (7) represent the proximate determinants of the country's NFA position. More fundamental factors, such as demographic trends, fiscal policy or productivity growth, can only affect the NFA position insofar as they impact on these expectations. Moreover, since the same SDF applies to all countries, such fundamental factors can only account for cross-country differences in NFA positions insofar as they impact prospective future trade flows.

3.2 Forecasting Implications

Equation (7) implies that all variations in a country's NFA position reflect revisions in expectations concerning future trade deficits and the world SDF. Consequently, NFA positions should have forecasting power for future trade flows and/or SDFs. To investigate this empirical implication, we must overcome two challenges: The first concerns the identification of the world SDF, $\mathcal{K}_t$. Section 4 describes how I estimate $\mathcal{K}_t$ from data on returns. The second arises from fact that the present value expression in (7) includes forecasts for $\mathcal{D}_{t+i}M_{n,t+i}$ and $\mathcal{D}_{t+i}X_{n,t+i}$ with $\mathcal{D}_{t+i} = \prod_{j=1}^{i}\mathcal{K}_{t+j}$ for all $i > 0$ rather and forecast for $M_{n,t+i}$, $X_{n,t+i}$ and $\mathcal{K}_{t+i}$ separately. To meet this challenge, I use a standard approximation.

To approximate the present value expression for each country's NFA position, I first rewrite (7) as

$$NFA_{n,t} = M_{n,t}\mathbb{E}_t\sum_{i=1}^{\infty}\exp\left(\textstyle\sum_{j=1}^{i}\Delta m_{n,t+j} + \kappa_{t+j}\right) - X_{n,t}\mathbb{E}_t\sum_{i=1}^{\infty}\exp\left(\textstyle\sum_{j=1}^{i}\Delta x_{n,t+j} + \kappa_{t+j}\right), \quad (8)$$

where $\kappa_t = \ln\mathcal{K}_t$ is the log SDF, and Δ is the first-difference operator. (Throughout I use lowercase letters to denote the natural log of a variable.) This transformation simply relates the NFA position to the current levels of imports and exports and their future growth rates, $\Delta m_{n,t+i}$ and $\Delta x_{n,t+i}$, rather than the future levels of exports and imports shown in (7).

Next, I approximate to the two terms involving expectations. If δ_t is a random variable with mean $\mathbb{E}[\delta_t] = \delta < 0$, then a first-order approximation to δ_{t+j} around δ produces

$$\begin{aligned}
\mathbb{E}_t\sum_{i=1}^{\infty}\exp\left(\textstyle\sum_{j=1}^{i}\delta_{t+j}\right) &= \mathbb{E}_t\exp(\delta_{t+1}) + \mathbb{E}_t\exp(\delta_{t+1}+\delta_{t+2}) + ... \\
&\simeq \frac{\rho}{1-\rho} + \rho\mathbb{E}_t(\delta_{t+1}-\delta) + \rho^2\mathbb{E}_t(\delta_{t+1}-\delta) + \rho^3\mathbb{E}_t(\delta_{t+2}-\delta) + ... \\
&= \frac{\rho}{1-\rho} + \frac{1}{1-\rho}\mathbb{E}_t\sum_{i=1}^{\infty}\rho^i(\delta_{t+i}-\delta), \qquad (9)
\end{aligned}$$

where $\rho = \exp(\delta) < 1$.

To apply this approximation, I make two assumptions:

$$\mathbb{E}[\Delta m_{n,t}] = \mathbb{E}[\Delta x_{n,t}] = g, \qquad \text{and} \qquad \text{(A1)}$$

$$g + \kappa = \delta < 0, \qquad \text{with} \quad \mathbb{E}[\kappa_t] = \kappa, \qquad \text{(A2)}$$

where $\mathbb{E}[.]$ denotes unconditional expectations. Under assumption A1 the mean growth rate for imports and exports are equal. This will be true of any economy on a balanced growth path and appears consistent with the empirical evidence for the G7 countries. To interpret assumption A2, note that in the steady state the log risk free rate r satisfies $1 = \mathbb{E}[\exp(\kappa_t)]\exp(r)$. Thus $\delta = g + \kappa \simeq g - r - \frac{1}{2}\mathbb{V}[\kappa_t]$, where $\mathbb{V}[.]$ denotes the variance, so A2 will hold provided $\mathbb{V}[\kappa_t] > 2(g-r)$. The mean growth rate for trade across the countries in the dataset is approximately 6.5 percent, which is well above any reasonable estimate of the mean risk free rate of close to 1 percent. Clearly then, A2 will only hold if the variance of the log SDF exceeds roughly $0.11 = 2(0.065 - 0.01)$. This volatility bound is easily exceeded by estimates of the log SDF derived below.

Applying the approximation in (9) to the expectations terms in (8) and simplifying the result gives

$$NFA_{n,t} = \tfrac{\rho}{1-\rho}\left(M_{n,t} - X_{n,t}\right) + \tfrac{1}{2(1-\rho)}\left(M_{n,t} + X_{n,t}\right)\mathbb{E}_t \sum_{i=1}^{\infty} \rho^i \left(\Delta m_{n,t+i} - \Delta x_{n,t+i}\right)$$
$$+ \tfrac{1}{1-\rho}\left(M_{n,t} - X_{n,t}\right)\mathbb{E}_t \sum_{i=1}^{\infty} \rho^i \left(\Delta \tau_{n,t+i} - g\right)$$
$$+ \tfrac{1}{1-\rho}\left(M_{n,t} - X_{n,t}\right)\mathbb{E}_t \sum_{i=1}^{\infty} \rho^i \left(\kappa_{t+i} - \kappa\right), \tag{10}$$

where $\Delta\tau_{n,t} = \frac{1}{2}(\Delta m_{n,t} + \Delta x_{n,t})$. This expression identifies the three sets of factors determining a country's NFA position in a clear fashion. The first term on the right-hand-side identifies the influence of the current trade balance. This would be the only factor determining the NFA position in the stochastic steady state where import growth, export growth and the log SDF followed i.i.d. processes because the terms involving expectations would equal zero. As such, this first term identifies the *atemporal* influence of trade flows on the NFA position. The remaining terms on the right-hand-side identify the intertemporal factors that were present in (7). In particular they make clear how expectations concerning future trade flows and financial conditions, represented by the world SDF, are (approximately) linked to a country's current NFA position.

The influence of future trade and financial conditions on external positions can be further clarified with a simply transformation of (10). For this purpose, I define country $n's$ external position by

$$NXA_{n,t} = \frac{NFA_{n,t}}{M_{n,t} + X_{n,t}} - \frac{\rho}{1-\rho} TD_{n,t} \qquad \text{where} \qquad TD_{n,t} = \frac{M_{n,t} - X_{n,t}}{M_{n,t} + X_{n,t}}.$$

In words, the country's NXA position is defined as the gap between its current NFA position and the steady state present value of the future trade deficits, all normalized by the current volume of international trade. Combining this definition with (10) gives

$$NXA_{n,t} = \tfrac{1}{2(1-\rho)}\mathbb{E}_t \sum_{i=1}^{\infty} \rho^i \left(\Delta m_{n,t+i} - \Delta x_{n,t+i}\right) + \tfrac{1}{1-\rho} TD_{n,t}\mathbb{E}_t \sum_{i=1}^{\infty} \rho^i \left(\Delta \tau_{n,t+i} - g\right)$$
$$+ \tfrac{1}{1-\rho} TD_{n,t}\mathbb{E}_t \sum_{i=1}^{\infty} \rho^i \left(\kappa_{t+i} - \kappa\right). \tag{11}$$

Equation (11) provides us with the (approximate) link between a country's current external position and expectations concerning future trade flows and the SDF that forms the basis for the empirical analysis below. For intuition, consider the effects of news that leads agents to revise their forecasts for future trade deficits upwards. If there is no change in the expected future path of the SDF, according to (7) there must be a rise in assets prices and/or a fall in liability prices that produces a rise in NFA if investors are to avoid participation in a Ponzi scheme. This link is represented by the first two terms on the right-hand-side of (11).

The third term on the right-hand-side of (11) identifies how news concerning the future financial conditions, as reflected by the SDF, affects a country's external position. To illustrate the economic intuition behind this term, consider the effect of news that lowers agents' forecasts of the future SDF but leaves their forecasts for future trade flows unchanged. Under these circumstances, (7) shows that future trade deficits are discounted more heavily so the country's current NFA position is more closely tied to the value of a claim on its near-term deficits. Thus the NFA positions of countries currently currently running trade deficits deteriorate while the NFA positions of those running current trade surpluses improve. These variations in NFA are reflected one-to-one in NXA.

Equation (11) contains expectations conditioned on the common information set of agents in period t, much of which is unavailable to researchers. To take this into account, let Φ_t denote a subset of agents' information at t that includes $NXA_{n,t}$ and $TD_{n,t}$. Taking expectations conditioned on Φ_t on both sides of (11) and applying the Law of Iterated Expectations, we find that

$$NXA_{n,t} = \tfrac{1}{2}\mathcal{PV}(\Delta m_{n,t} - \Delta x_{n,t}) + TD_{n,t}\mathcal{PV}(\Delta\tau_{n,t} - g) + TD_{n,t}\mathcal{PV}(\kappa_t - \kappa), \tag{12}$$

where $\mathcal{PV}(\upsilon_t) = \frac{1}{1-\rho}\sum_{i=1}^{\infty}\rho^i\mathbb{E}\left[\upsilon_{t+i}|\Phi_t\right]$. This equation takes the same form as (11) except the agents' expectations are replaced by expectations conditioned on Φ_t. Conditioning down in this manner doesn't affect the link between the country's external position and the expectations because information used by agents is effectively contained in Φ_t via the presence of $NXA_{n,t}$ and $TD_{n,t}$.

The implications of (12) for forecasting are straightforward. NXA should have forecasting power for any stationary variable y_{t+k} insofar as expected future values of that variable, $\mathbb{E}\left[y_{t+k}|\Phi_t\right]$, are correlated with the present value terms on the right-hand side of (12). Suppose, for the sake of illustration, that y_t is independent of the trade flows and that the country n's long-run trade deficit is equal to TD_n. Then a projection of y_{t+k} on $NXA_{n,t}$ (i.e. a regression without an intercept) would produce a projection coefficient equal to

$$\begin{aligned}\frac{\mathbb{E}\left[y_{t+k}NXA_{n,t}\right]}{\mathbb{E}\left[NXA_{n,t}^2\right]} &= \frac{1}{1-\rho}\mathbb{E}\left[TD_{n,t}\sum_{i=1}^{\infty}\rho^i\frac{\mathbb{E}\left[\left(\kappa_{t+i}-\kappa\right)|\Phi_t\right]y_{t+k}}{\mathbb{E}\left[NXA_{n,t}^2\right]}\right] \\ &= \frac{TD_n}{1-\rho}\sum_{i=1}^{\infty}\rho^i\frac{\mathbb{CV}\left[\mathbb{E}[\kappa_{t+i}|\Phi_t],\mathbb{E}[y_{t+k}|\Phi_t]\right]}{\mathbb{E}\left[NXA_{n,t}^2\right]}.\end{aligned}$$

where $\mathbb{CV}[.,.]$ denotes the covariance. Notice that in this case the size of the coefficient depends on the both long run trade deficit, TD_n, and the covariance between the expectations of y_{t+k} and κ_{t+i} over a range of horizons i. In the empirical analysis below, I examine the forecasting power of $NXA_{n,t}$ for future trade flows with $y_t = \Delta m_t - \Delta x_t$ and $y_t = \Delta\tau_t$, and future financial conditions with $y_t = \kappa_t$ at particular horizons k. I also study the forecasting power of $NXA_{n,t}$ for trade and financial conditions over a range of horizons (i.e. for all $k \geq 1$) using time series estimates of

$\mathcal{PV}(\Delta m_{n,t} - \Delta x_{n,t})$, $\mathcal{PV}(\Delta \tau_{n,t} - g)$ and $\mathcal{PV}(\kappa_t - \kappa)$.

4 Empirical Methods

4.1 Estimating the World SDF

In a fully specified theoretical model of the world economy the world SDF would be identified from the equilibrium conditions governing investors' portfolio and savings decisions. Fortunately, for our purposes, we can avoid such a complex undertaking. Instead, I adopt a "reverse-engineering" approach in which I construct a specification for the SDF that explains the behavior of a set of returns; the returns on the asset and liability portfolios for six of the G7 countries.[5] This approach is easy to implement and allows us to empirically examine how prospective future financial conditions are reflected in external positions.

Let $\mathbf{er}_{t+1}$ denote a $k \times 1$ vector of log excess portfolio returns, $er^i_{t+1} = r^i_{t+1} - r^{\text{TB}}_{t+1}$, where r^i_{t+1} denotes the log return on portfolio i and r^{TB}_{t+1} is the log return on U.S. T-bills. I assume that the log of the SDF is determined as

$$\kappa_{t+1} = a - r^{\text{TB}}_{t+1} - b'(\mathbf{er}_{t+1} - \mathbb{E}[\mathbf{er}_{t+1}]). \tag{13}$$

This specification for the SDF contains $k + 1$ parameters: the constant a and the $k \times 1$ vector b. In the "reverse-engineering" approach values for these parameters are chosen to ensure that the no-arbitrage conditions are satisfied for the specified SDF. More specifically, I find values for a and b such that the portfolio returns for the asset and liability portfolios of the six G7 countries and the U.S. T-bill rate all satisfy the no-arbitrage conditions.

Consider the condition for the $i'th$ portfolio return: $1 = \mathbb{E}_t[\exp(\kappa_{t+1} + r^i_{t+1})]$. Taking unconditional expectations we can rewrite this condition as

$$\begin{aligned} 1 &= \mathbb{E}[\exp(\kappa_{t+1} + r^i_{t+1})] \\ &\simeq \exp\left(\mathbb{E}[\kappa_{t+1} + r^i_{t+1}] + \tfrac{1}{2}\mathbb{V}[\kappa_{t+1} + r^i_{t+1}]\right). \end{aligned} \tag{14}$$

When the log returns are normally distributed the second line holds with equality because (13) implies that κ_{t+1} and $r^i_{t+1}$are jointly normal. Otherwise, the second line includes an approximation error.

Next, I substituting for the log SDF from (13) in (14) and take logs. After some re-arrangement this gives

$$a + \mathbb{E}\left[er^i_{t+1}\right] + \tfrac{1}{2}\mathbb{V}\left[er^i_{t+1}\right] + \tfrac{1}{2}b'\mathbb{V}\left[\mathbf{er}_{t+1}\right]b = \mathbb{CV}\left[er^i_{t+1}, \mathbf{er}'_{t+1}\right]b. \tag{15}$$

[5]Unfortunately, the data needed to compute the returns on Canada's foreign asset and liability positions is not available from the IMF database before 2006, so I use the returns of the other six G7 countries.

This equation must hold for the T-bill return (i.e., when $r_{t+1}^{i}=r_{t+1}^{\text{TB}}$, or $er_{t+1}^{i}=0$) so

$$a+\tfrac{1}{2}b'\mathbb{V}\left[\mathbf{er}_{t+1}\right]b=0. \tag{16}$$

Imposing this restriction on (15) gives

$$\mathbb{E}\left[er_{t+1}^{i}\right]+\tfrac{1}{2}\mathbb{V}\left[er_{t+1}^{i}\right]=\mathbb{CV}\left[er_{t+1}^{i},\mathbf{er}_{t+1}'\right]b.$$

This equation holds for each of the k portfolio returns. So stacking the k equations we obtain

$$\mathbb{E}\left[\mathbf{er}_{t+1}\right]+\tfrac{1}{2}\Lambda=\Omega b, \tag{17}$$

where $\Omega=\mathbb{V}[\mathbf{er}_{t+1}]$ and Λ is a $k\times 1$ vector containing the leading diagonal of Ω.

Finally, we can solve (16) and (17). Substituting the solutions for a and b in (13) produces the following expression for the log SDF:

$$\kappa_{t+1}=-\tfrac{1}{2}\mu'\Omega^{-1}\mu-r_{t+1}^{\text{TB}}-\mu'\Omega^{-1}(\mathbf{er}_{t+1}-\mathbb{E}[\mathbf{er}_{t+1}]). \tag{18}$$

By construction, equation (18) identifies a specification for the log SDF such that the unconditional no-arbitrage condition, $1=\mathbb{E}[\exp(\kappa_{t+1}+r_{t+1}^{i})]$, holds for the k log portfolio returns and the return on U.S. T-bills. This specification would also satisfy the conditional no-arbitrage condition, $1=\mathbb{E}_t[\exp(\kappa_{t+1}+r_{t+1}^{i})]$, if log returns were independently and identically distributed. However, since this is not the case, we need to amend the specification to incorporate conditioning information.

Consider condition $1=\mathbb{E}_t[\exp(\kappa_{t+1}+r_{t+1}^{i})]$. Let ω_t be a valid instrument known to market participants in period t. Multiplying both sides of the no-arbitrage condition by $\exp(\omega_t)$ and taking unconditional expectations produces, after some re-arrangement

$$1=\mathbb{E}\left[\exp(\kappa_{t+1}+r_{t+1}^{i,\omega})\right], \tag{19}$$

where $r_{t+1}^{i,\omega}=r_{t+1}^{i}+\omega_t-\ln\mathbb{E}[\exp(\omega_t)]$. Notice that (19) takes the same form as (14) used in the constructions of the log SDF in (18). The only difference is that (19) contains the adjusted log return on portfolio i, $r_{t+1}^{i,\omega}$, rather than the unadjusted return r_{t+1}^{i}. This means that we can reverse engineer a specification for the log SDF that incorporates the conditioning information if we add adjusted log returns to the set of returns. Specifically, let $er_{t+1}^{i,\omega^j}=r_{t+1}^{i}-r_{t+1}^{\text{TB}}+\omega_t^j-\ln\mathbb{E}[\exp(\omega_t^j)]$ denote the log excess adjusted return on portfolio i using instrument ω_t^j. If $\mathbf{er}_{t+1}$ now represents a vector containing er_{t+1}^{i} and er_{t+1}^{i,ω^j}, the log SDF identified in (18) will satisfy the non-arbitrage condition

$$1=\mathbb{E}\left[\exp(\kappa_{t+1}+r_{t+1}^{i})\middle|\,\omega_t^j\right],$$

for all the portfolio returns i and instruments ω_t^j included in $\mathbf{er}_{t+1}$.

Three aspects of this reverse engineering procedure deserve comment. First, equation (18) doesn't necessarily identify a unique SDF that satisfies the no-arbitrage conditions for a set of returns. Indeed, we know as a matter of theory that many SDF exist when markets are incomplete. Rather the specification in (18) identifies *one* specification for the SDF that satisfies the no-arbitrage conditions. Second, this reverse engineering approach makes no attempt to relate the SDF to underlying macro factors. This complex task is unnecessary if our aim is simply to identify how prospective future financial conditions affect external positions. The third aspect concerns the use of instrumental variables to control for conditioning information. In principle the conditional expectations of market participants that appear in the no-arbitrage conditions equal expectations conditioned on every instrumental variable in their information set. In practice, there is a limit to the number of instruments we can incorporate into the log SDF specification. I chose instruments that have forecasting power for log excess portfolio returns and I examine the robustness of my results to alternative specifications for the log SDF based on different instrument choices.

I consider two empirical specifications for the log SDF. The first, denoted by $\hat{\kappa}_t^{\text{I}}$, is estimated from (18) without conditioning information. To assess whether the estimates satisfy the no-arbitrage condition, $1 = \mathbb{E}[\exp(\hat{\kappa}_{t+1}^{\text{I}} + r_{t+1}^i)|\omega_t^j]$, I estimate regressions of the form:

$$\exp(\hat{\kappa}_{t+1}^{\text{I}} + r_{t+1}^i) - 1 = b_1(fa_{n,t} - fl_{n,t}) + b_2(x_{n,t} - m_{n,t}) + v_{t+1}, \tag{20}$$

where $x_{n,t}$, $m_{n,t}$, $fa_{n,t}$ and $fl_{n,t}$ denote the logs of exports, imports, the value of foreign assets and foreign liabilities, respectively, for country n. Panel A of Table 1 reports the estimation results for the log returns on the asset and liability portfolios. Notice that the log ratios of assets-to-liabilities and export-to-imports are valid instruments so the estimates of b_1 and b_2 should be statistically insignificant under the null of a correctly specified SDF. As Panel A shows, this is not the case for the portfolio returns of four countries. The log asset-to-liability ratio has predictive power for German, U.K. and U.S. returns, while the log export-to-import ratio has power for the returns on Japanese assets.

In the light of these results, I incorporate conditioning information in my second specification for the log SDF, denoted by $\hat{\kappa}_t^{\text{II}}$. Specifically, I now add the adjusted log return on U.S. assets, $r_{t+1}^{i,z} = r_{\text{US},t+1}^{\text{A}} + (fa_{\text{US},t} - fl_{\text{US},t}) - \ln \mathbb{E}[\exp(fa_{\text{US},t} - fl_{\text{US},t})]$, where $r_{\text{US},t+1}^{\text{A}}$ is the log return on U.S. assets, to the set of returns used to estimate the log SDF in (18). This specification incorporates information concerning the future value of the SDF that is correlated with variations in the U.S. NFA position. Thus, $fa_{\text{US},t} - fl_{\text{US},t}$ should not have forecasting power for $\exp(\hat{\kappa}_{t+1}^{\text{II}} + r_{t+1}^i) - 1$ by construction. To check whether the other instruments retain their forecasting power, I then re-estimate regression (20) with $\hat{\kappa}_{t+1}^{\text{II}}$ replacing $\hat{\kappa}_{t+1}^{\text{I}}$. Panel B of Table 1 reports these regression results. In contrast to Panel A, none of the b_1 and b_2 coefficient estimates are statistically significant. Notice, also, that the R^2 statistics are (in most cases) an order of magnitude smaller than their counterparts in Panel A. The asset-to-liability and export-to-import ratios do not account for an economically

Table 1: Forecasting Returns

	Asset Returns			Liability Returns		
	b_1	b_2	R^2	b_1	b_2	R^2
A: $\hat{\kappa}^{\text{I}}$						
France	0.059	-0.210	-0.001	0.117	-0.205	0.003
Germany	-0.428*	0.669	0.124	-0.442**	0.594	0.129
Italy	-1.031	2.436	0.135	-1.009	2.667*	0.143
Japan	0.299	2.304**	0.098	0.327	2.374	0.106
United Kingdom	-5.852**	0.324	0.183	-5.843**	0.437	0.177
United States	-1.108**	0.216	0.132	-1.059**	0.252	0.115
B: $\hat{\kappa}^{\text{II}}$						
France	-0.188	-0.636	0.023	-0.116	-0.610	0.017
Germany	-0.083	2.824	0.057	-0.091	2.862	0.059
Italy	-0.653	-0.668	0.018	-0.653	-0.453	0.016
Japan	0.742	1.809	0.050	0.774	1.874	0.055
United Kingdom	-4.595	2.237	0.052	-4.698	2.529	0.054
United States	-0.229	0.515	0.022	-0.163	0.558	0.023

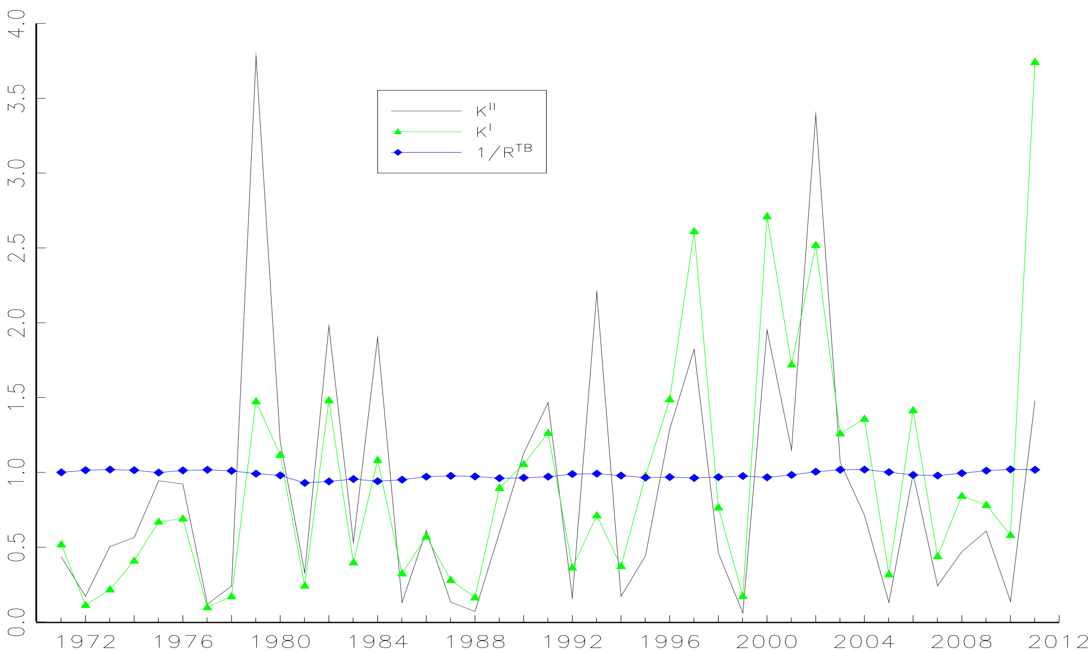
Notes: The table reports the OLS estimates of the regression (20) using the κ_t^{I} specification for the log SDF in panel A and the κ_t^{II} specification in panel B. "**" and "*" indicate statistical significance at the 5% and 10% levels, respectively. All regression estimated in annual data between 1971 and 2011.

meaningful fraction of the variation in $\exp(\hat{\kappa}_{t+1}^{\text{II}} + r_{t+1}^{i}) - 1$. These findings appear robust to the choice of estimation period and instruments. Re-estimating (20) over a sample period that ends in 2007 gives essentially the same results. I also find statistically insignificant coefficients in regressions using $\hat{\kappa}_{t+1}^{\text{II}}$ as the log SDF when GDP growth rates and/or lagged returns are used as alternate instruments.[6]

Figure 1 plots the two estimated SDFs, $\hat{\mathcal{K}}_t^{\text{I}} = \exp(\hat{\kappa}_t^{\text{I}})$ and $\hat{\mathcal{K}}_t^{\text{II}} = \exp(\hat{\kappa}_t^{\text{II}})$, together with the inverse of the real return on U.S. T-bills, $1/R_t^{\text{TB}}$. In the special case where the expected excess portfolio returns on assets and liabilities are zero, equation (18) implies that the SDF is equal to $1/R_t^{\text{TB}}$. Thus differences between $1/R_t^{\text{TB}}$ and the estimated SDF's arise because the SDFs must account for the expected excess portfolio returns. As the plots clearly show, both estimates of the SDF are more volatile than $1/R_t^{\text{TB}}$. In fact, variations in the log return on U.S. T-bills contribute less than one percent to the sample variance of $\hat{\kappa}_t^{\text{I}}$ and $\hat{\kappa}_t^{\text{II}}$. Changes in U.S. T-bill returns do not appear to have an economically significant impact on estimates of the SDF that "explain" returns on asset and liability portfolios in major economies. The plots in Figure 1 also show that there are numerous episodes where the estimated SDFs are well above one. Ex ante, the conditionally expected value of the SDF, $\mathbb{E}_t\mathcal{K}_{t+1}$, identifies the value of a claim to one real dollar next period. So safe dollar assets sold at a premium during periods where these high values for the SDF were forecast ex ante.

[6] Recall that specification for κ_t in (18) was derived using a log normal approximation to evaluate expected future returns. Based of these regression estimates, there is no evidence to suggest that the approximation is a significant source of specification error for $\hat{\kappa}_t^{\text{II}}$.

Figure 1: SDF Estimates



Notes: The figure plots two estimates of the world SDF, $\hat{\mathcal{K}}_t^{\text{I}} = \exp(\hat{\kappa}_t^{\text{I}})$ and $\hat{\mathcal{K}}_t^{\text{II}} = \exp(\hat{\kappa}_t^{\text{II}})$, with κ_t determined in (18); and the inverse of the real return on U.S. T-bills, $1/R_t^{\text{TB}}$.

4.2 Estimating External Positions

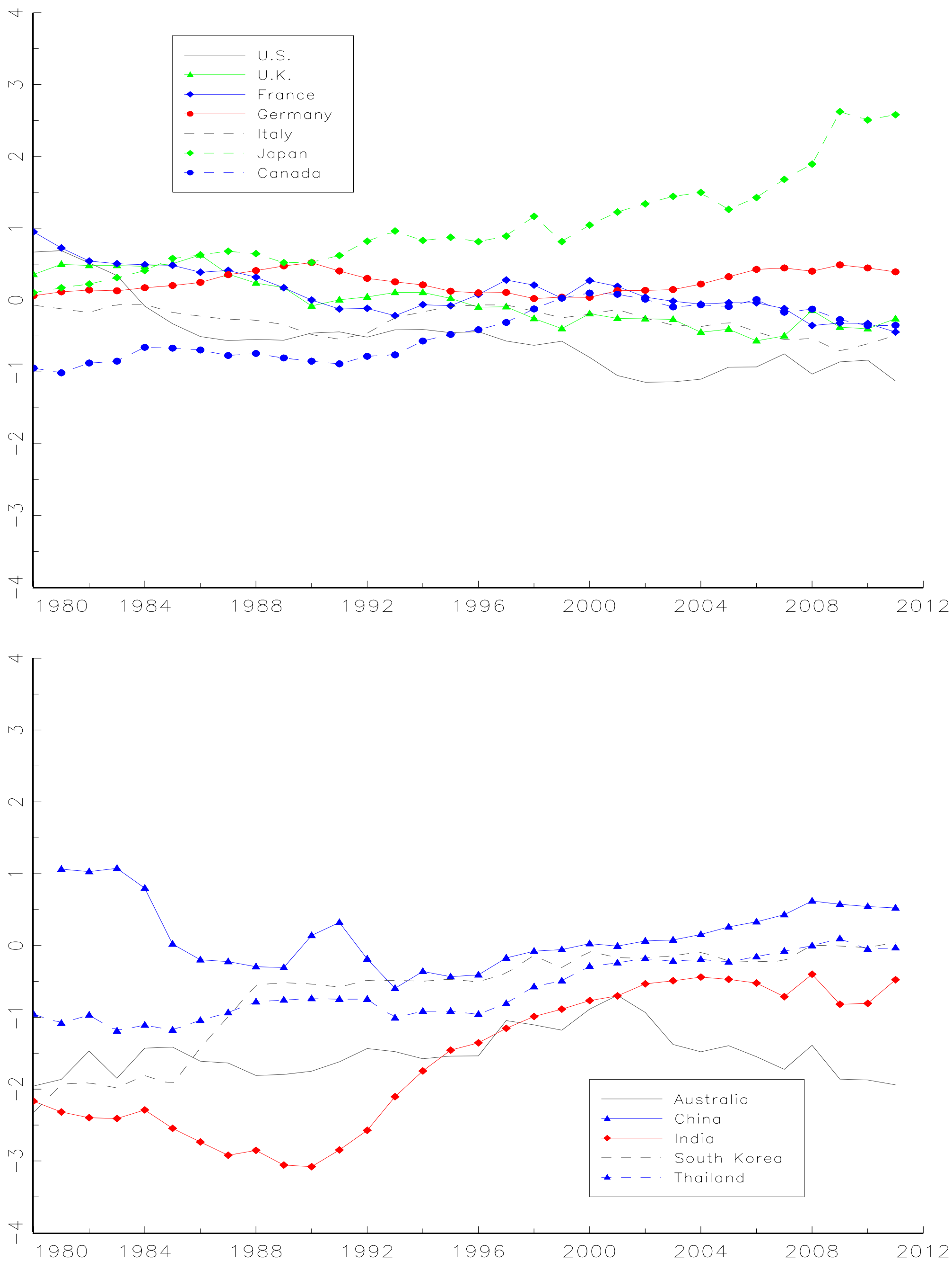
The estimates of the log SDF, $\hat{\kappa}_t^{\text{II}}$, allow us to pin down the discount rate $\rho = \exp(g + \kappa)$ used in computing the NXA positions and the present value terms in equation (12). Recall that g is the unconditional growth rate for exports and imports, which I estimate to be 0.064 from the pooled average of import and export growth across countries. My estimate of κ computed from the average value of $\hat{\kappa}_t^{\text{II}}$ is -0.59. These estimates, denoted by $\hat{g}$ and $\hat{\kappa}$, imply a discount rate of $\rho = \exp(\hat{g} + \hat{\kappa}) = 0.586$. This is the value I use to construct the NXA measures of each country's external position.

Figure 2 plots the NXA positions for each country in the dataset between 1980 and 2011. The upper panel shows that the NXA positions for all but one of the G7 countries have remained between ± 1 during the past 30 years. The one exception is the Japanese NXA position, which persistently increased from 0.1 to 2.6 during the period. Variations in the NXA positions of countries outside the G7 are generally larger. The plots in the lower panel of Figure 2 show large improvements in the external positions of India and South Korea while Australia's NXA position has remained largely unchanged. It is also interesting to note that the steady improvement in the NXA position of China in the last twenty years is not nearly as pronounced as the improvement in Japan's position.[7] Of

[7] The span of the sample period is much too short for unit roots tests to provide reliable information on the whether the true process for each country's NXA position is stationary. On the other hand the economic logic embedded in equation (12) implies that $NXA_{n,t}$ is indeed a stationary process, and so my analysis in Section 5 proceeds under this assumption.

course the time series for the NXA positions reflect changes in NFA positions and trade deficits both measured as a fraction of annual trade, $NFA_{n,t}/(M_{n,t}+X_{n,t})$ and $(M_{n,t}-X_{n,t})/(M_{n,t}+X_{n,t})$. Plots for these variables are shown in the Web Appendix.

Figure 2: NXA Positions



4.3 Long-Horizon Forecasts

In principle, variations in the NXA positions could reflect revisions in the expectations concerning the *entire* path for future imports, exports and the SDF. One way to investigate this possibility would be to estimate regressions of realized present values; i.e., $\sum_{i=1}^{k} \rho^i y_{t+i}$ for $y_t = \{\Delta m_t - \Delta x_t,\ \Delta\tau_t - g,$ $\kappa_t - \kappa\}$, on $NXA_{n,t}$ for some finite horizon k. For example, with ρ equal to 0.586, $\rho^i < 0.01$ for $i > 8$, so a finite horizon of eight or nine years ought to be sufficient for this purpose. Unfortunately, there are two well-known econometric problems with this approach. First, the coefficient estimates may suffer from finite sample bias when the independent variables are persistent and predetermined but not exogenous (see, e.g. Campbell and Yogo 2006). Second, the asymptotic distribution of the estimates provides a poor approximation to the true distribution when the forecasting horizon is long relative to the span of the sample (see, e.g. Mark, 1995), as it would be here with just a 40 year span.

To avoid these problems, I examine the relation between the NXA positions and $\sum_{i=1}^{\infty} \rho^i \hat{\mathbb{E}}_t y_{t+i}$, where the conditional expectations $\hat{\mathbb{E}}_t y_{t+i}$ are computed from VARs. Specifically, let the vector $z_t = [\ y_t, ., ..\ ]'$ follow a p'th. order VAR, which can be written in companion form as $Z_t = AZ_{t-1} + U_t$, where Z_t stacks the z_t vectors appropriately. I estimate the present value for y_t by

$$\widehat{\mathcal{PV}}(y_t) \quad = \tfrac{1}{1-\rho} \textstyle\sum_{i=1}^{\infty} \rho^i \hat{\mathbb{E}}_t y_{t+i} = \quad \tfrac{\rho}{1-\rho} \imath_1 \hat{A}(I - \rho\hat{A})^{-1} Z_t, \tag{21}$$

where $\imath_1$ is a vector that picks out the first row of Z_t (i.e., $y_t = \imath_1 Z_t$) and $\hat{A}$ denotes the estimated companion matrix from the VAR. [The $1/(1-\rho)$ term is included for compatibility with the expression for the NXA position in equation (12)]. I compute present values for trade flows where $y_t = \Delta m_{n,t} - \Delta x_{n,t}$ or $y_t = \Delta\tau_{n,t} - \hat{g}$ from VARs estimated country-by-country, and for the log SDF with $y_t = \kappa_t^{\text{II}} - \hat{\kappa}$ using a single world-wide specification. In all these calculations $\rho = \exp(\hat{g} + \hat{\kappa}) = 0.586$.

I estimate the present value terms involving future trade flows (i.e., $\widehat{\mathcal{PV}}(\Delta m_{n,t} - \Delta x_{n,t})$ and $\widehat{\mathcal{PV}}(\Delta\tau_{n,t} - \hat{g})$) from VARs that include the import-export growth differential $\Delta m_{n,t} - \Delta x_{n,t}$, trade growth $\Delta\tau_{n,t}$, and the log export-to-import ratio $x_{n,t} - m_{n,t}$. Below I report results based on first-order VARs estimated separately for each country, n; higher-order VARs give very similar results. In addition, I considered estimates that included $NXA_{n,t}$ and the log return on U.S. T-bills, r_t^{TB}, in the VARs. The results presented below are robust with respect to the presence of these variables.[8]

I also use a VAR to compute the present value of the log SDF, $\widehat{\mathcal{PV}}(\hat{\kappa}_t^{\text{II}} - \hat{\kappa})$. In this case the VAR includes $\hat{\kappa}_t^{\text{II}} - \hat{\kappa}$, the log return on U.S. T-bills, r_t^{TB}, the U.S. inflation rate, π_t^{US}, the spread between the real yields on ten and one year U.S. T-bonds, spr_t^{US}, and the average rate of real GDP growth across the G7, Δy_t^{G7}. In addition, I use the VAR to compute the present value of the log return on

[8] The Web Appendix examines the time series predictability of the import-export growth differential and the trade growth differential across the countries in the sample. It also documents the results of Grange Causality tests from the estimated VARs.

U.S. T-bills, $\widehat{\mathcal{PV}}(r_t^{\text{TB}} - \hat{r}^{\text{TB}})$, where $\hat{r}^{\text{TB}}$ is the sample average of r_t^{TB}. Comparing $\widehat{\mathcal{PV}}(\hat{\kappa}_t^{\text{II}} - \hat{\kappa})$ with $\widehat{\mathcal{PV}}(r_t^{\text{TB}} - \hat{r}^{\text{TB}})$ proves useful when we examine how future financial conditional are reflected in the NXA positions below.

5 Results

5.1 Forecasting Future Trade Flows

I begin by examining the short-horizon forecasting power of the NXA positions for trade flows. Panel A of Table 2 reports slope coefficients, (heteroskedastic-consistent) standard errors and R^2 statistics from regressions of y_{t+1} on a constant and $NXA_{n,t}$ for each of the countries, n, over the full sample. Columns I and II show estimates where $y_{t+1} = \Delta m_{n,t+1} - \Delta x_{n,t+1}$ and $y_{t+1} = (\Delta\tau_{n,t+1} - \hat{g})TD_{n,t}$ are the forecast variables, respectively. These are the trade flows that appear in the present value terms that determine the NXA position of country n in equation (12). The estimates in column III use the combination of trade flows that appears on the right-hand side of (12).

The results in Panel A of Table 2 show that information contained in the NXA positions concerning future near-term trade flows differs considerably across countries. Among the G7, there is no evidence that the NXA positions contain information about next year's import-export growth differential; none of the estimated slope coefficients are statistically significant at conventional levels. By contrast, the NXA positions of China and South Korea appear to have reasonably strong forecasting power for the differential. In both cases an increase in the NXA position forecasts a rise in $\Delta m_{n,t+1} - \Delta x_{n,t+1}$. Ceteris paribus, this is consistent with equation (12). For perspective on the size of coefficient estimates, the value of 10.3 implies that an increase in the Chinese NXA position of 0.1 forecasts an increase in the growth differential of approximately one percent.

External positions have more widespread forecasting power for trade growth. Column II shows that six slope coefficients are statistically significant at the one percent level. According to (12), an increases in $NXA_{n,t}$ should, ceteris paribus, forecast a rise in trade growth for current deficit countries and a fall in growth for surplus countries. This prediction is not borne out in five of the six countries with significant coefficients. Finally, column III shows the forecasting power of the NXA positions for the combined trade flows. Here there is very little evidence of any short-horizon forecasting power. With the exception of China, none of the estimated slope coefficients are statistically significant at the 10 percent level, and all the R^2 statistics are extremely small.

All-in-all, the results in Panel A suggest that variations in prospective near-term trade flows play no more than a minor role in driving variations in external positions. This doesn't mean that future trade flows are irrelevant. On the contrary, changes in external positions could reflect revisions in expectations concerning the entire future path for trade flows (i.e. expectations well beyond the one year horizon studied above). The results in Panel B of Table 2 allow us to examine this possibility. Here I report the estimates from regressions of the VAR-based present values of trade flows on a

Table 2: Forecasting Trade Flows

A: Short Horizon Forecasts

Forecast Variables	I $\Delta m_{n,t+1} - \Delta x_{n,t+1}$			II $\Delta \tau_{n,t+1} TD_{n,t}$			III $\Delta m_{n,t+1} - \Delta x_{n,t+1} + \Delta \tau_{n,t+1} TD_{n,t}$		
	coeff	std	R^2	coeff	std	R^2	coeff	std	R^2
Canada	2.407	(1.811)	0.042	0.141	(0.186)	0.014	1.345	(0.885)	0.055
France	-0.698	(0.646)	0.028	0.187***	(0.037)	0.386	-0.163	(0.323)	0.006
Germany	4.693	(3.818)	0.036	-0.802***	(0.280)	0.170	1.544	(1.991)	0.015
Italy	5.121	(3.683)	0.046	0.222	(0.236)	0.022	2.782	(1.848)	0.054
Japan	2.338	(1.947)	0.035	-0.210	(0.186)	0.031	0.959	(0.992)	0.023
United Kingdom	1.925	(1.806)	0.028	-0.419***	(0.096)	0.325	0.543	(0.883)	0.009
United States	0.877	(1.822)	0.006	-0.064	(0.199)	0.003	0.374	(0.919)	0.004
Australia	-1.279	(4.853)	0.002	-0.308	(0.316)	0.023	-0.947	(2.374)	0.004
China	10.311**	(4.929)	0.131	-0.920***	(0.351)	0.192	4.235*	(2.395)	0.097
India	0.518	(0.848)	0.009	-0.028	(0.099)	0.002	0.231	(0.457)	0.006
South Korea	2.603**	(1.108)	0.124	-1.276***	(0.171)	0.588	0.025	(0.574)	0.000
Thailand	8.945*	(5.356)	0.065	-1.688***	(0.656)	0.142	2.785	(2.635)	0.027

B: Long-Horizon Forecasts

Forecast Variables	I $\widehat{\mathcal{PV}}(\Delta m_{n,t} - \Delta x_{n,t})$			II $\widehat{\mathcal{PV}}(\Delta \tau_{n,t} - g) TD_{n,t}$			III $\widehat{\mathcal{PV}}(\Delta m_{n,t} - \Delta x_{n,t}) + \widehat{\mathcal{PV}}(\Delta \tau_{n,t} - g) TD_{n,t}$		
	coeff	std	R^2	coeff	std	R^2	coeff	std	R^2
Canada	1.923	(1.244)	0.058	0.144	(0.386)	0.004	2.067	(1.478)	0.048
France	-1.123***	(0.315)	0.246	-0.405***	(0.130)	0.199	-1.528***	(0.443)	0.234
Germany	7.750***	(1.530)	0.397	3.233***	(0.699)	0.354	10.982***	(2.213)	0.387
Italy	0.021	(2.105)	0.000	0.237	(0.814)	0.002	0.258	(2.908)	0.000
Japan	3.848***	(0.933)	0.304	0.607	(0.429)	0.049	4.455***	(1.309)	0.229
United Kingdom	5.004***	(0.725)	0.550	2.281***	(0.302)	0.594	7.284***	(0.900)	0.627
United States	3.522**	(1.585)	0.112	1.039***	(0.361)	0.175	4.562**	(1.898)	0.129
Australia	5.338***	(1.980)	0.157	2.021**	(0.969)	0.100	7.359***	(2.498)	0.182
China	12.564***	(2.117)	0.548	2.911***	(0.651)	0.408	15.475***	(2.683)	0.534
India	2.647***	(0.281)	0.695	1.923***	(0.289)	0.531	4.569***	(0.487)	0.693
South Korea	3.216***	(0.449)	0.568	-0.002	(0.251)	0.000	3.214***	(0.650)	0.385
Thailand	13.923***	(2.012)	0.551	4.706***	(0.836)	0.448	18.628***	(2.526)	0.582

Notes: The table reports OLS estimates of the slope coefficients, (heteroskedastic-consistent) standard errors and R^2 statistics from regressions of the variables shown at the top of each panel on $NXA_{n,t}$ and (an unreported constant). Each row reports estimates for country n. “***”, ”“**” and “*” indicate statistical significance at the 1%, 5% and 10% levels, respectively. All regressions estimated in annual data between 1971 and 2011.

constant and $NXA_{n,t}$. Notice that these are not forecasting regressions - the dependent variable is not the realized present value of the future trade flows. Rather the regressions measure the degree to which changes in the present value of future trade flows computed from VAR forecasts are reflected in $NXA_{n,t}$ variations.[9] If the forecasting information captured by the VARs is also embedded in agents' expectations that are reflected in the NXA positions, we should expect to find positive and statistically significant slope coefficients.

The results reported in Panel B generally confirm this prediction. The slope coefficients in column I are positive and highly statistically significant for nine countries. And, judging by the R^2 statistics, the variations in $NXA_{n,t}$ capture a sizable portion of the variance in the VAR-based present values for the import-export growth differential. This evidence is consistent with notion that the information contained in the long-term VAR forecasts for $\Delta m_{n,t+i} - \Delta x_{n,t+i}$ is positively correlated with that used to form the actual expectations embedded in the NXA positions. The estimates based on French data prove an exception to this pattern. Here the slope coefficient is negative and highly statistically significant - a counterintuitive finding. The estimates shown in Panel II continue this pattern. In this case the slope coefficients are positive and highly statistically significant in seven countries, with France again proving the exception. Column III shows how the VAR-based forecast for the combined future trade flows relate to external positions. Again, the slope coefficients are positive and highly significant for most countries (except France). It is also worth noting that the R^2 statistics from these regressions are over 0.5 in the U.K., China, India, and Thailand. The time series variations in the NXA positions of these countries during the past 40 years are quite informative about changes in the VAR forecasts of future trade flows.

Overall, the results in Table 2 are consistent with the view that changing expectations about trade flows far into the future contribute to the year-by-year variations in the NXA positions of many countries. Expectations concerning near-term trade flows appear far less relevant. These results are broadly consistent with the findings reported by Gourinchas and Rey (2007a). They estimate that changing expectations concerning future trade flows account for approximated 30 percent of the cyclical variations in the U.S. external position between 1952 and 2004. Here variations in the U.S. NXA position are strongly correlated with the forecasts of future trade flows, but not as strongly as the NXA positions of other countries.

5.2 Forecasting Future Financial Conditions

I now consider the influence of prospective financial conditions on country's external positions. Panel A of Table 3 reports on the short-horizon forecasting power of the NXA positions for different measures of future financial conditions. As above, the table shows slope coefficients, (heteroskedastic-

[9]The VAR-based present values used as left-hand-side variables in these regressions include some sampling error. Importantly, the results reported in the table are derived from VARs that do not include $NXA_{n,t}$, so there is no reason to suspect that this sampling error contributes to the estimated regression coefficients. Furthermore, when I estimate regressions using VAR-based present values that include $NXA_{n,t}$ in the VAR specification, I obtain very similar results.

consistent) standard errors and R^2 statistics from regressions of the forecast variable on a constant and $NXA_{n,t}$ estimated over the full sample. Recall that variations in the expected log SDF only affect $NXA_{n,t}$ insofar as the country is running a current trade surplus or deficit, so the forecast variables are multiplied by the current trade deficit, $TD_{n,t}$, to be consistent with the right-hand-side of (12).

Column I shows the results when $NXA_{n,t}$ is used to forecast the one-year ahead deviation of the log SDF from its unconditional mean multiplied by the current trade deficit, $(\hat{\kappa}^{\text{II}}_{t+1} - \hat{\kappa})TD_{n,t}$. Recall that, ceteris paribus, an increase in the expected future SDF should raise (lower) the NXA position of a deficit (surplus) country because future trade imbalances are discounted more heavily when valuing current asset and liability positions. So, if revisions in expected near-term financial conditions are a source of $NXA_{n,t}$ variations over the sample, and those expectations are reflected in actual conditions as represented by the SDF estimates, we should see positive and significant slope coefficients in the forecasting equations. The estimates in Column I show that this is the case for four countries: Germany, the United Kingdom, India and South Korea. $NXA_{n,t}$ does not appear to have significant near-term forecasting power across the other countries, with the exception of France; where, once again, the significant negative coefficient is counterintuitive.[10]

Columns II and III provide further perspective on these findings. Here I show the results from forecasting regressions that include the log return on U.S. T-bills, r^{TB}_{t+1}. In the absence of arbitrage opportunities $1 = \mathbb{E}_t[\exp(\hat{\kappa}^{\text{II}}_{t+1} + r^{\text{TB}}_{t+1})]$, which (approximately) implies that $\mathbb{E}_t[\kappa_{t+1} + r^{\text{TB}}_{t+1}] = -\frac{1}{2}\mathbb{V}_t[\kappa^{\text{II}}_{t+1} + r^{\text{TB}}_{t+1}]$, where $\mathbb{V}_t[.]$ denotes the conditional variance. Subtracting unconditional expectations from both sides and re-arranging using (18) gives

$$\mathbb{E}_t[\kappa_{t+1} - \kappa] = -\mathbb{E}_t\left[r^{\text{TB}}_{t+1} - r^{\text{TB}}\right] - \tfrac{1}{2}\left\{\mathbb{V}_t[b'\boldsymbol{er}_{t+1}] - \mathbb{E}\left[\mathbb{V}_t[b'\boldsymbol{er}_{t+1}]\right]\right\}. \tag{22}$$

Thus, changing expectations concerning the future SDF must either reflect revisions in expected future T-bill returns and/or changes in perceived risk measured by the conditional variance of future excess portfolio returns on asset and liabilities across the major economies.

Column II shows the regression results when the T-bill returns (multiplied by the trade deficit) are the forecast variable. Here we see a different cross-country pattern of forecasting power. The NXA position have forecasting power for near-term T-bill returns in Italy, Japan, Australia, China and Thailand; all countries where $NXA_{n,t}$ appeared not to forecast the log SDF. When judged by the R^2 statistics, these forecasting results are particularly strong in the Chinese and Thai cases. Column III shows results when $\hat{\kappa}^{\text{II}}_{t+1} + r^{\text{TB}}_{t+1}$ (multiplied by the trade deficit) is used as the forecast variable. Mathematically, the estimated slope coefficients are equal to the difference between their counterparts in columns I and II, but economically they show the extent to which changing per-

[10] Gourinchas and Rey (2007a) found that the U.S. external position had forecasting power for the return on the net asset position and the return differential between equity assets and liabilities at the quarterly horizon between 1952 and 2004. One possible reason for the difference between their findings and the U.S. forecasting results in Panel A is that $NXA_{n,t}$ exhibits a good deal more persistence than the cyclical component of the U.S. external position they use.

Table 3: Forecasting Financial Conditions

I: Short Horizon Forecasts

Forecast Variables	I: $(\hat{\kappa}^{\text{II}}_{t+1}-\hat{\kappa})TD_{n,t}$ coeff	std	R^2	II: $-(r^{\text{TB}}_{t+1}-r^{\text{TB}})TD_{n,t}$ coeff	std	R^2	III: $(\hat{\kappa}^{\text{II}}_{t+1}+r^{\text{TB}}_{t+1})TD_{n,t}$ coeff	std	R^2
Canada	-3.216	(3.567)	0.020	-0.017	(0.084)	0.001	-3.200	(3.562)	0.020
France	-2.277***	(0.697)	0.215	0.008	(0.014)	0.008	-2.285***	(0.693)	0.218
Germany	13.258***	(4.172)	0.206	0.005	(0.092)	0.000	13.253***	(4.166)	0.206
Italy	-6.327	(3.810)	0.066	0.222***	(0.079)	0.169	-6.549*	(3.804)	0.071
Japan	3.439	(2.499)	0.046	-0.146**	(0.058)	0.142	3.585	(2.477)	0.051
United Kingdom	6.548**	(2.571)	0.143	0.252***	(0.072)	0.238	6.295**	(2.589)	0.132
United States	1.834	(4.113)	0.005	0.039	(0.077)	0.006	1.795	(4.104)	0.005
Australia	-2.234	(6.107)	0.003	-0.239**	(0.099)	0.130	-1.996	(6.093)	0.003
China	6.216	(3.999)	0.079	0.347***	(0.088)	0.357	5.869	(3.992)	0.072
India	5.476**	(2.469)	0.112	-0.034	(0.065)	0.007	5.510**	(2.474)	0.113
South Korea	6.630***	(1.709)	0.284	-0.083*	(0.043)	0.090	6.712***	(1.714)	0.288
Thailand	5.795	(7.428)	0.015	0.727***	(0.165)	0.332	5.068	(7.480)	0.012

II: Long-Horizon Forecasts

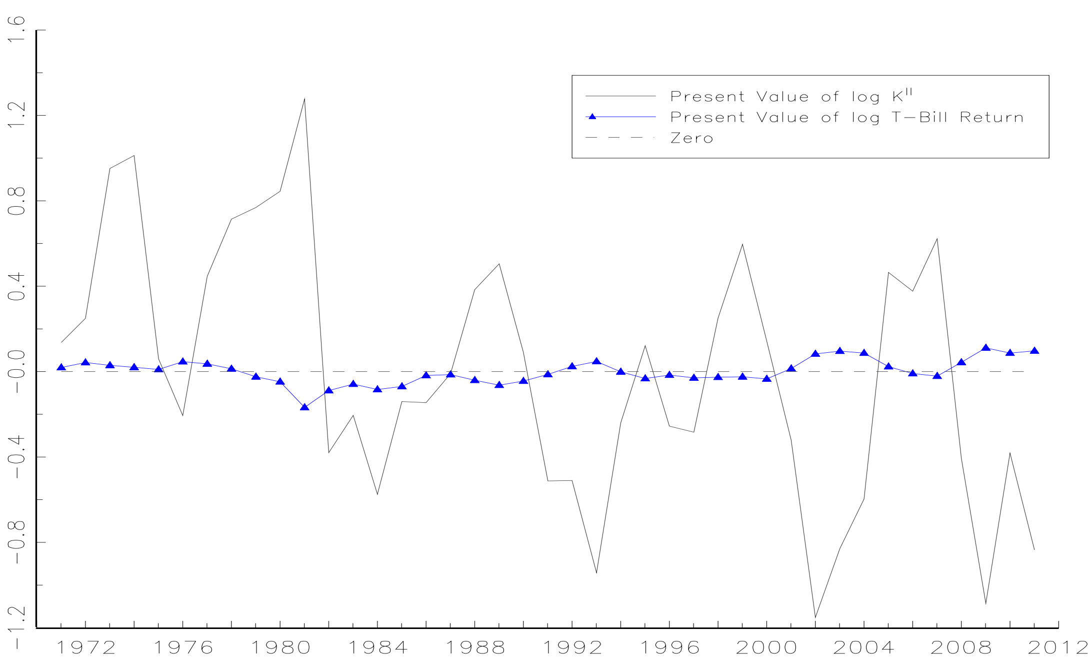
Forecast Variables	I: $\widehat{\mathcal{PV}}(\hat{\kappa}^{\text{II}}_{t}-\hat{\kappa})TD_{n,t}$ coeff	std	R^2	II: $-\widehat{\mathcal{PV}}(r^{\text{TB}}_{t}-r^{\text{TB}})TD_{n,t}$ coeff	std	R^2	III: $\widehat{\mathcal{PV}}(\hat{\kappa}^{\text{II}}_{t}+r^{\text{TB}}_{t})TD_{n,t}$ coeff	std	R^2
Canada	2.525	(1.644)	0.057	-0.467***	(0.152)	0.195	2.992*	(1.706)	0.073
France	0.812**	(0.378)	0.106	-0.146***	(0.039)	0.268	0.959**	(0.405)	0.126
Germany	-2.153	(2.523)	0.018	0.340*	(0.194)	0.073	-2.493	(2.604)	0.023
Italy	2.537	(2.183)	0.033	-0.558**	(0.256)	0.109	3.095	(2.400)	0.041
Japan	-0.374	(1.167)	0.003	0.299**	(0.116)	0.145	-0.672	(1.262)	0.007
United Kingdom	-1.371	(1.553)	0.020	0.070	(0.173)	0.004	-1.441	(1.661)	0.019
United States	5.293***	(1.752)	0.190	-0.692***	(0.156)	0.336	5.985***	(1.790)	0.223
Australia	4.777*	(2.625)	0.078	-0.148	(0.300)	0.006	4.924*	(2.801)	0.073
China	2.721	(1.997)	0.060	-0.318**	(0.135)	0.160	3.040	(2.048)	0.071
India	-3.247**	(1.246)	0.148	0.558***	(0.150)	0.263	-3.805***	(1.341)	0.171
South Korea	-3.168***	(0.901)	0.241	0.650***	(0.096)	0.543	-3.818***	(0.973)	0.283
Thailand	0.189	(4.080)	0.000	-0.338	(0.551)	0.010	0.527	(4.500)	0.000

Notes: The table reports OLS estimates of the slope coefficients, (heteroskedastic-consistent) standard errors and R^2 statistics from regressions of the variables shown at the top of each panel on $NXA_{n,t}$ and (an unreported constant). Each row reports estimates for country n. “***”, ”**” and “*” indicate statistical significance at the 1%, 5% and 10% levels, respectively. All regressions estimated in annual data between 1971 and 2011.

ceptions concerning near-term risk is reflected in the NXA positions. Notice that the cross-country pattern of the coefficient estimates closely corresponds to the pattern in column I. To the extent that $NXA_{n,t}$ variations reflect prospective near-term financial conditions, revisions in perceived risk appear more important than expectations concerning future returns on U.S. T-bills.

Of course $NXA_{n,t}$ variations may reflect revisions in expectations concerning the SDF further into the future. To gauge the importance of variations in these long-horizon expectations, Figure 3 plots the estimated present value for the log SDF, $\widehat{\mathcal{PV}}(\hat{\kappa}_t^{\text{II}} - \hat{\kappa})$, and minus one times the estimated present value of the return on U.S. T-bills $-\widehat{\mathcal{PV}}(r_t^{\text{TB}} - \hat{r}^{\text{TB}})$. The plotted series are computed from a VAR estimated from the full sample. Alternative series derived from a VAR estimated on pre-crisis data (1971-2006) follow a similar pattern. As the figure clearly shows, time series variations in the present value for the log SDF follow a cyclical pattern and are much larger in magnitude than the changes in the present value of the log return on U.S. T-bills. This means that the changing VAR forecasts for the log SDF largely reflect revisions in perceived future risk, represented by the last term on the right-hand-side of (22). For example, the sizable swings in the log SDF between 1998 and 2008 appear to reflect, in turn, an large rise, fall, and rise again in expectations concerning the level of risk well into the future.

Figure 3: The Present Value of the log SDF



Notes: The figure plots the estimated present value of the log SDF, $\widehat{\mathcal{PV}}(\hat{\kappa}_t^{\text{II}} - \hat{\kappa})$, and minus one times the present value of the log return on U.S. T-bills $-\widehat{\mathcal{PV}}(r_t^{\text{TB}} - \hat{r}^{\text{TB}})$.

To what extent are these estimates of changing risk perceptions reflected in the NXA positions? To address this question Panel B of Table 3 reports estimates from regressions of the VAR-based present values of the log SDF and T-bill returns on a constant and $NXA_{n,t}$. As in Panel A, the dependent variables in these regressions are multiplied by the trade deficit for consistency with the right-hand-side of (12). The estimates in Column I show that the variations in NXA are only weakly related to those in $\widehat{\mathcal{PV}}(\hat{\kappa}_t^{\text{II}} - \hat{\kappa})TD_{n,t}$ for many countries. The most notable exception is the United States, where the estimated slope coefficient is positive, highly statistically significant, and the R^2 is 0.19. This finding contrasts with the U.S. estimates in Panel A, where the coefficient is insignificant and the R^2 statistic is smaller that 0.01. It suggests that changes in the U.S. external position are in part a reflection of changing perceptions concerning future financial conditions beyond the immediate future, particular future risk. The NXA positions of three other countries also appear to reflect prospective future financial conditions. The estimate slope coefficient on the French NXA position is positive and significant, but the regression R^2 is only 0.1, while those for India and South Korean are negative and significant.

The cross-country pattern of statistical significance changes when we focus on forecasts for U.S. T-bill returns. Column II shows that the NXA positions of many countries are quite closely related to $-\widehat{\mathcal{PV}}(r_t^{\text{TB}} - \hat{r}^{\text{TB}})TD_{n,t}$: the estimated slope coefficients are significant at the five percent level in eight countries. To interpret these estimates, recall from Table 2 that most country's NXA positions appeared to reflect prospective future trade conditions. Their NXA positions will also reflect long-term forecasts for U.S. T-bill returns insofar as they are correlated with their forecasts for future trade flows. The estimation results in column II reflect these correlations and the importance of expected future trade flows for the determination of NXA across countries. Finally, note that the results in column III closely mirror those in column I. This is due to the fact that the changing VAR forecasts for the future log SDF primarily reflect revisions in the forecasts of risk rather than U.S. T-bill returns (see Figure 3).

Overall, the results in Table 3 provide only limited support for the view that revisions in expectations about future financial conditions contribute significantly to the changing NXA positions across countries. Although the VAR s forecasts reveal sizable and persistent swings in the present value of the log SDF, the NXA positions of most countries are not strongly correlated with this measure of prospective financial conditions. The one notable exception to this pattern is the United States, where variations in the NXA position are strongly correlated with the estimated present value of the future SDF.

6 Conclusion

In the absence of Ponzi schemes and arbitrage opportunities, the NFA position of any country must equal the expected present discounted value of future trade deficits, discounted at the cumulated world SDF. In this paper I investigated the forecasting implications of this theoretical insight. To do so, I first developed a measure of a country's external position, $NXA_{n,t}$, that is simply linked to expectations of future trade flows and the log SDF. I also showed how the SDF can be estimated from cross-country data on returns. With these tools I then studied the near-term forecasting power of 12 country's NXA positions for trade flows and the SDF, and the statistical link between the NXA positions and VAR forecasts for the paths of trade flows and the SDF far into the future.

Overall, my empirical findings support the prediction that the external positions of most countries reflect (in part) expectations about the future path for trade flows. Evidence on the role of future financial conditions is less clear cut. While the VAR forecasts for SDF suggest that there have been persistent and sizable variations in the prospective future financial conditions that are relevant for the determination of NXA positions, only the U.S. NXA position is strongly correlated with these forecasts. This suggests that identifying the impact of future financial conditions on many country's NXA positions requires a more structural empirical investigation than the simple forecasting exercise undertaken here. One possibility along these lines would be to extend the VAR methods pioneered by Campbell and Shiller (1987) to allow for the nonlinearity between the trade deficits and the present value terms in equation (12) - a possibility I leave for future work.

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Appendix

A Data Description

Figure A1 provides a visual perspective on the behavior of external positions and trade flows across the world's major economies. Panels A and C plot the ratio of each country's NFA position (i.e., the difference between the value of its foreign asset and liability portfolios) to GDP between 1980 and 2011. These plots display two noteworthy features. First, they clearly show that variations in the NFA/GDP ratios of many countries are highly persistent, with significant movements often lasting decades. The second feature concerns the dispersion of the ratios across countries. Panel A shows that the dispersion has increased markedly across the G7 in the last decade, with ratios ranging from -20 to 80 percent of GDP in 2011. With the notable exception of Canada, imbalances between the value of foreign assets and liabilities have been steadily growing across the G7 for the past 30 years. Panel C shows that the dispersion in NFA/GDP ratios also increased across the non-G7 countries in the last decade. Panels B and D plot the ratios of net exports (exports minus imports) to GDP for the comparable countries over the same sample period. Again, we can see that these ratios display a good deal of time series persistence. Among the G7, the ratios have become most dispersed since the early 1990s, while there is no clear change in the dispersion of the ratios among the other countries.

The plots in Figure A1 follow the standard practice of measuring NFA positions and net exports relative to GDP. This normalization facilitates comparisons of external positions and trade flows across countries with economies of different sizes at a point in time, but is less useful when considering dynamic links between current positions and future trade flows on a country-by-country basis. To help understand why, Figure A2 plots the sum of foreign asset and liability positions as a fraction of GDP and the sum of exports and imports as a fraction of GDP for each of the countries in the dataset between 1980 and 2011. Clearly, both trade and gross foreign positions have been growing persistently relative to GDP in every country. Moreover, it is clear that gross positions rose particularly rapidly in the last decade. The plots in Figure A2 also illustrate how the cross-country differences in the degree of openness (both in terms of trade flows and gross positions) have increased over time.

Table A1 provides statistical evidence complimenting the plots in Figure A2. Panel A reports sample statistics for the annual growth in trade, gross positions, and the export-import growth differential. Trade growth is computed as the average growth rate for real exports and imports $\frac{1}{2}(\Delta x_t+\Delta m_t)$, position growth by the average growth in foreign assets and liabilities $\frac{1}{2}(\Delta fa_t+\Delta fl_t)$, and the export-import differential as the difference between the growth in exports and imports, $\Delta x_t - \Delta m_t$; where x_t, m_t, fa_t and fl_t denote the logs of exports, imports, the value of foreign assets and foreign liabilities, respectively; and Δ is the first-difference operator. (Throughout I use lowercase letters to denote the natural log of a variable.) As the table shows, mean trade growth and mean position growth are similar across the G7 countries, with mean position growth roughly

Figure A1: Net Foreign Assets and Net Exports

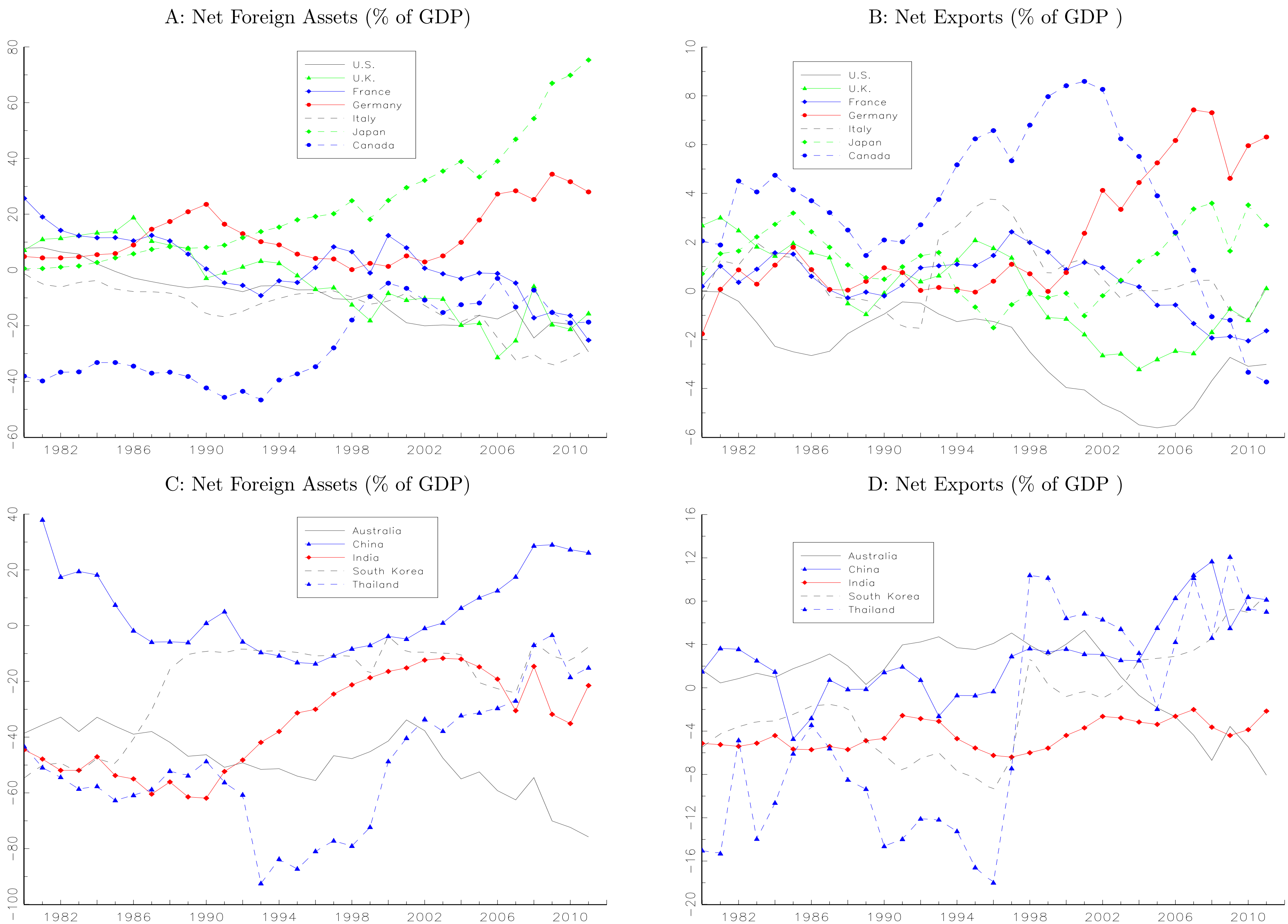


Figure A2: Total Assets and Trade

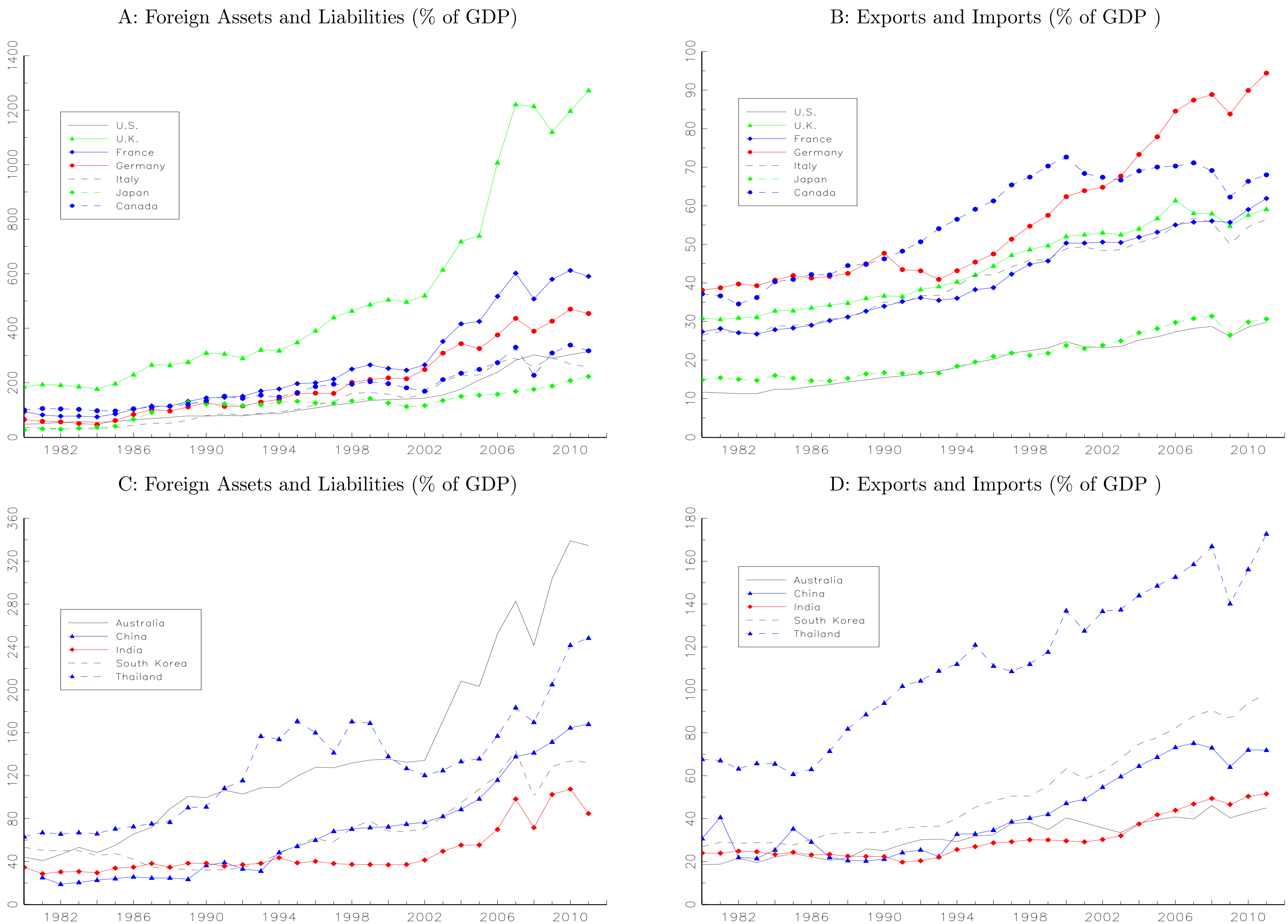


Table A1: Growth in Trade and Foreign Positions

	Trade Growth			Position Growth			Export-Import Differential		
	Mean	Std.	AR(1)	Mean	Std.	AR(1)	Mean	Std.	AR(1)
A:									
Canada	4.660	5.557	0.138	6.083	10.153	-0.289	-0.836	4.764	0.208
France	4.790	4.238	0.083	8.343	9.318	0.148	0.276	3.641	-0.039
Germany	5.057	4.573	0.031	9.099	11.186	0.226	0.560	3.827	0.053
Italy	4.190	5.290	-0.107	6.920	11.988	0.307	0.657	5.552	0.063
Japan	5.081	6.986	-0.132	9.711	12.926	0.472	1.047	9.263	0.129
United Kingdom	4.200	4.142	0.148	9.348	8.775	0.282	-0.116	3.770	0.204
United States	5.652	5.356	0.047	8.446	5.430	0.368	0.379	7.368	0.538
Australia	5.481	4.837	-0.310	9.016	13.770	0.069	-1.253	10.461	-0.017
China	12.090	10.131	0.140	16.850	7.890	-0.043	0.157	13.208	-0.017
India	7.771	6.718	0.249	8.924	12.694	0.199	1.274	7.035	0.071
South Korea	11.529	8.635	0.058	11.661	12.475	-0.018	2.842	11.106	0.068
Thailand	8.172	9.239	0.022	9.778	10.858	0.259	1.736	12.911	-0.292
Average	6.552	4.456	-0.117	8.751	7.175	0.144	0.453	2.799	0.140
B: Relative to GDP Growth									
Canada	1.787	4.075	0.162	3.210	10.447	-0.294			
France	2.579	3.086	-0.023	6.131	9.157	0.080			
Germany	2.759	3.807	0.144	6.800	11.015	0.173			
Italy	2.177	3.834	-0.177	4.907	12.135	0.222			
Japan	2.477	5.854	-0.236	7.107	12.032	0.402			
United Kingdom	2.042	2.987	-0.114	7.191	7.961	0.243			
United States	2.877	3.758	-0.071	5.671	4.971	0.312			
Australia	2.271	8.438	-0.327	5.806	11.887	-0.017			
China	1.900	17.822	0.049	6.660	14.096	-0.042			
India	2.554	6.759	0.067	3.708	15.679	-0.042			
South Korea	5.316	6.549	0.103	5.448	12.693	-0.064			
Thailand	2.503	7.398	-0.189	4.109	10.152	0.048			
Average	2.624	3.827	-0.189	4.822	6.863	0.064			

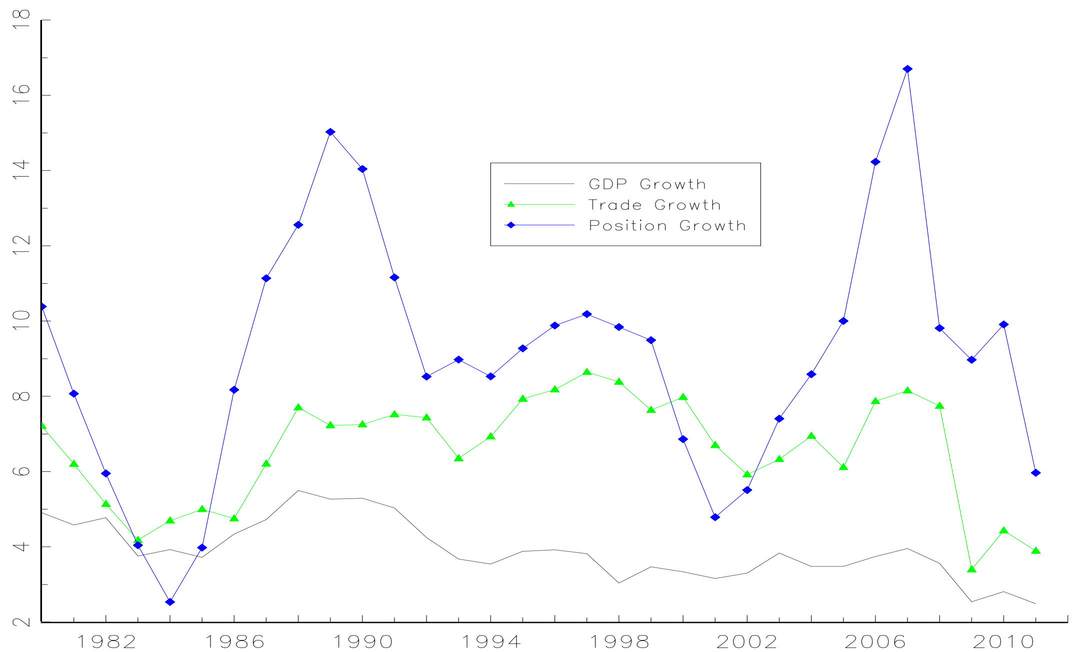
Notes: Panel A reports the sample mean and standard deviation and first order autocorrelation coefficient for: (i) trade growth $\frac{1}{2}(\Delta x_t + \Delta m_t)$, (ii) the position growth $\frac{1}{2}(\Delta fa_t + \Delta mfl_t)$, and (iii) the export-import growth differential $\Delta x_t - \Delta m_t$; where x_t, m_t fa_t and fl_t denote the logs of exports, imports, the value of foreign assets and foreign liabilities, respectively (in constant U.S. dollars). Panel B reports statistics for (i) the relative growth in trade $\frac{1}{2}(\Delta x_t + \Delta m_t) - \Delta y_t$ and (ii) the relative growth in positions liabilities $\frac{1}{2}(\Delta fa_t + \Delta mfl_t) - \Delta y_t$; where y_t denotes the log of real GDP. Growth rates are expressed in annual percent. All statistics are computed over the sample period of 1971-2011.

two to four precent higher. Cross-country differences in mean trade and position growth rates are more pronounced across the other countries. The mean export-import growth differentials shown in the right-hand columns are small by comparison. Some of the cross-country differences in the mean trade and position growth rates reflect differences in the degree of economic development that in turn are reflected in GDP growth. This can be seen in Panel B where I report statistics for trade growth and position growth relative to GDP growth, measured as $\frac{1}{2}(\Delta x_t + \Delta m_t) - \Delta y_t$ and $\frac{1}{2}(\Delta fa_t + \Delta fl_t) - \Delta y_t$, respectively; where y_t is the log of real GDP. Here the cross-country differences in mean growth rates are much smaller. Notice, however, that mean rates are all positive. Averaging across all the countries, trade grew approximately 2.6 percent faster than GDP, while foreign asset and liability positions grew 4.8 percent faster.

Figure A2 and Table A1 show that, on average, the growth in global trade and financial positions have greatly exceeded global output growth in the last three decades. Year-by-year, the picture is more complicated. Figure A3 plots the five-year moving average of the cross-country average for GDP growth, trade growth and position growth between 1980 and 2011. These growth rates are computed as $\frac{1}{N}\sum_n \Delta y_{n,t}$, $\frac{1}{2N}\sum_n(\Delta x_{n,t} + \Delta m_{n,t})$ and $\frac{1}{2N}\sum_n(\Delta fa_{n,t} + \Delta fl_{n,t})$, respectively; from the trade and position data of each country $n = \{1, 2, ...N\}$. The plots reveal that swings in global trade growth and position growth have been much larger than global business cycles represented by the growth in GDP. The size and timing of the swings in position growth are even more striking. The last three decades witnessed two episodes of increasingly rapid growth in foreign asset and liability positions; the first in the mid-1980's and the second between 2000 and 2006. Conversely, growth declined markedly in three episodes; the first in the early 1980's, the second following the 1997 Asian crises, and the third starting in 2007. The first and third episodes also witnessed a significant fall in trade growth.

The growth in both trade and positions relative to GDP present a challenge, because these features are absent from standard models. For example, in typical open-economy DSGE models consumers' preferences tie exports and imports to relative prices and domestic consumption (see, e.g. Evans, 2011). In these models relative prices are constant in the steady state so exports and imports share the same trend as output. This means that trade growth cannot exceed output growth in the long run. Similarly, open-economy models with many financial assets predict that position growth equals output growth in the long run, so a country's position shares the same long run trend as GDP (see, e.g., Evans, 2014, or the models surveyed in Coeurdacier and Rey, 2012).

Figure A3: Global Growth Rates



Notes: The figure plots the five-year moving average of the cross-country averages for: (i) GDP growth $\frac{1}{N}\sum_n \Delta y_{n,t}$, (ii) trade growth $\frac{1}{2N}\sum_n(\Delta x_{n,t}+\Delta m_{n,t})$ and (iii) position growth $\frac{1}{2N}\sum_n \Delta fa_{n,t}+\Delta fl_{n,t})$ all in annual percent.

B Forecasting Trade and the SDF

Table A2 provides information on the time series predictability of the import-export growth differential and trade growth across the countries in the sample. Specifically, here I report the estimates from two regressions:

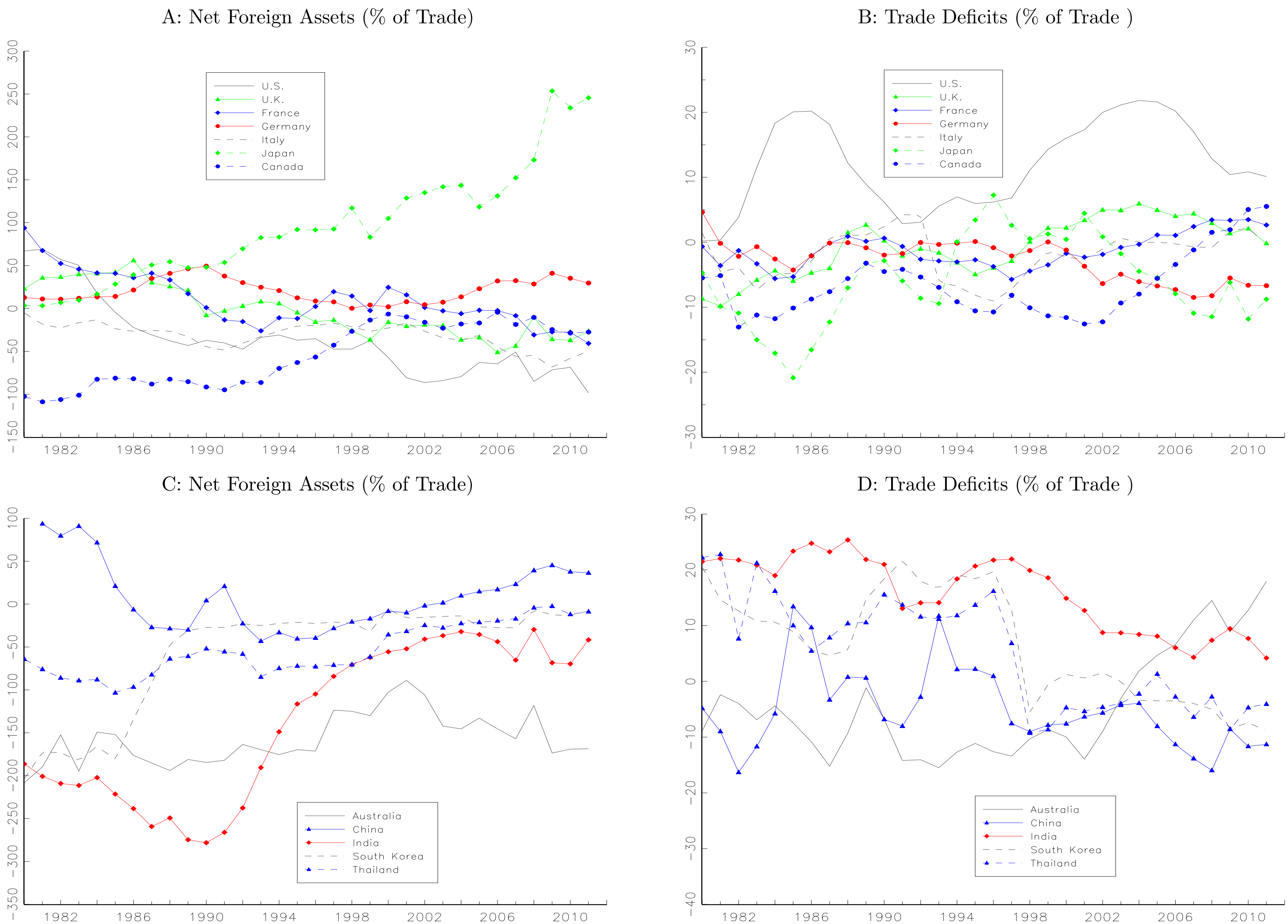
$$\Delta m_{n,t+1}-\Delta x_{n,t+1}=c_0+c_1(x_{n,t}-m_{n,t}-\widehat{\mu}_n)+c_2(\Delta m_{n,t}-\Delta x_{n,t})+v_{n,t+1} \qquad (23)$$

and

$$\Delta \tau_{n,t+1}-\hat{g}=d_0+d_1(x_{n,t}-m_{n,t}-\hat{\mu}_n)+d_2(\Delta\tau_{n,t}-\hat{g})+v_{n,t+1}, \qquad (24)$$

where $\hat{\mu}_n$ denotes the sample average of $x_{n,t}-m_{n,t}$. The left-hand-panel of the table shows that there is a good deal of time series predictability in the import-export growth differential. In all but four countries, the estimates of c_1 are positive and statistically significant. Thus, future imports tend to grow at a faster rate than exports when the log export-to-import ratio is above its historical norm (i.e., $\hat{\mu}_n$). This pattern of predictability is consistent with the presence of cointegration between $x_{n,t}$ and $m_{n,t}$. Lagged import-export growth also has predictive power in the case of the United States and China. The estimates of regression (24) reported in the right-hand panel show much less evidence of predictability in trade growth. In only two countries, Australia and India, are any of

Figure A4: Net Foreign Assets and Net Exports



the slope coefficients statistically significant at the five percent level. I also estimated augmented versions of regressions (23) and (24) that included $NXA_{n,t}$ as an additional right-hand-side variable. Table A2 reports the asymptotic p-values for tests of the null hypothesis that the coefficients on $NXA_{n,t}$ in these regression equal zero. As the table shows, there is little evidence to reject this null in the regressions for the import-export growth differentials. In the case of the trade growth regressions, the p-values are quite small for France, Italy, Australia and South Korea, indicating that $NXA_{n,t}$ may have incremental forecasting power in these countries.

Table A2: Forecasting Trade Flows

	Import-Export Growth				Trade Growth			
	c_1	c_2	R^2	P-value	d_1	d_2	R^2	P-value
Canada	9.095	0.275	0.108	0.322	10.845	0.089	0.080	0.132
France	19.963**	0.015	0.136	0.724	4.349	0.113	0.015	0.058
Germany	12.903**	0.119	0.103	0.722	-5.917	0.036	0.016	0.770
Italy	17.201**	0.134	0.126	0.092	-1.743	-0.045	0.003	0.071
Japan	15.729**	0.195	0.114	0.899	-9.487	-0.185	0.076	0.507
United Kingdom	10.169	0.229	0.091	0.693	1.890	0.165	0.028	0.407
United States	26.553**	0.663**	0.510	0.312	-4.950	0.031	0.018	0.600
Australia	8.058	0.039	0.033	0.390	4.276	-0.284**	0.130	0.021
China	46.757**	0.272**	0.309	0.913	14.897	0.282*	0.106	0.289
India	13.477**	0.121	0.129	0.455	11.936**	0.153	0.147	0.498
South Korea	13.852**	0.070	0.151	0.794	-6.968	0.014	0.062	0.032
Thailand	11.297	-0.244	0.135	0.322	1.930	0.034	0.004	0.378

Notes: The left- and right-hand panels reports the OLS estimates of the slope coefficients and the R^2 statistics from regressions (23) and (24), respectively. Each row reports estimates for country n. The column headed "P-value" reports the p-value for the null that the coefficient on $NXA_{n,t}$ equals zero computed from augmented versions on (23) and (24) that include $NXA_{n,t}$ as an additional right-hand-side variable. "**" and "*" indicate statistical significance at the 5% and 10% levels, respectively. All regressions estimated in annual data between 1971 and 2011.

Table A3 reports the results of Grange Causality tests for all of the equations in the first-order VAR used to estimate the present values of the log SDF, $\widehat{\mathcal{PV}}(\hat{\kappa}_t^{\text{II}} - \hat{\kappa})$, and the log return on U.S. T-bills, $\widehat{\mathcal{PV}}(r_t^{\text{TB}} - \hat{r}^{\text{TB}})$. The table shows that there is a good deal of time-series predictability among the variables: many of the p-values for the null of no Granger Causality are extremely small.

Table A3: Grange Causality Tests for SDF VAR

Forecasting Variables	VAR Equations				
	$\hat{\kappa}_t^{\text{II}} - \hat{\kappa}^{\text{II}}$	r_t^{TB}	π_t^{US}	Δy_t^{G7}	spr_t^{US}
$\hat{\kappa}_t^{\text{II}} - \hat{\kappa}^{\text{II}}$	2.265	3.880	0.165	0.264	11.772
	(0.132)	(0.049)	(0.684)	(0.608)	(0.001)
r_t^{TB}	0.593	275.525	117.032	0.907	12.038
	(0.441)	(0.000)	(0.000)	(0.341)	(0.001)
π_t^{US}	0.585	5.301	707.723	5.417	0.132
	(0.444)	(0.021)	(0.000)	(0.020)	(0.716)
Δy_t^{G7}	0.140	0.212	57.861	11.324	29.779
	(0.709)	(0.646)	(0.000)	(0.001)	(0.000)
spr_t^{US}	3.726	3.978	21.967	23.438	66.432
	(0.054)	(0.046)	(0.000)	(0.000)	(0.000)

Notes: The tables reports χ^2 statistics for the null that the coefficients on (lags of) the forecasting variables listed on left are equal to zero in the VAR equations for the variables listed at the head of each column. Asymptotic p-values are reported in parenthesis. Test are computed from estimates of a first-order VAR. Entries equal to 0.000 denote p-values <0.001.